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The Soapstone City

Virginia Alberene Corp., Schuyler, Va., Has a Unique Industrial Community

By H. Herbert Hughes

NESTLED AMONG the rolling hills of Piedmont, Va., lies Schuyler, a thriving little community entirely dependent upon soapstone and the Virginia Alberene Corp. for its existence. It is located in Nelson county near the Albemarle county line. The 1930 census gives the population of the Schuyler district as 3362. Apparently no count was made in the village proper, which in 1920 was listed as containing 320 inhabitants. Since the company now employs about 520 workers, and at least 600 in normal times, it is evident that the surrounding territory supplies many of the employes. In fact, the company operates a work train each morning and evening to accommodate the men who live along or near the right-of-way.

Many of these "commuters" leave home before daylight to tramp across fields to the railroad, and it may be dark before they get back in the evening. Efforts of the company, however, to have them move into company houses at Schuyler usually meet the same response: "Me and the ole woman talked it over and we 'lowed we'd stay where we was 'cause we ain't never lived nowheres else."

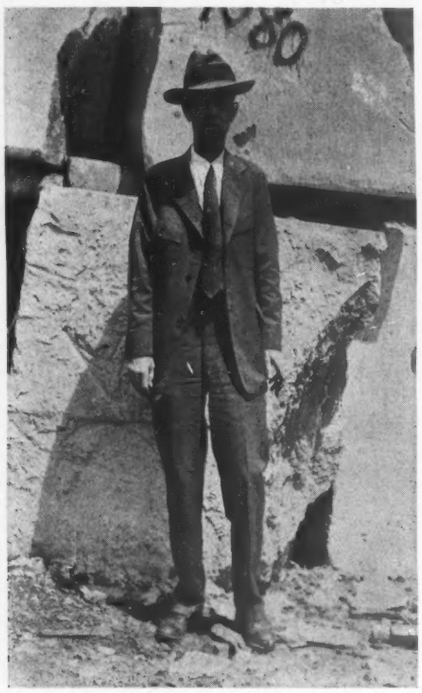
Labor troubles are unknown at Schuyler. All employes are native Americans and more than 90% of them were born and reared in the community. Sons follow fathers in the employ of the company. Instances are numerous where three generations work side by side in the quarries or plant. Wages at Schuyler are slightly higher than the general wage scale throughout the South.

The morale of the employes is excellent. Stories are told of loyal workers who refused higher wages elsewhere because they valued the dependability of the Virginia Alberene Corp. higher than a few additional cents per hour. Another interesting example

General view of the plant of the Virginia Alberene Corp., with worked-out quarries in background

Panorama of Schuyler

of cooperation and loyalty was brought out recently when the present economic depression began to be reflected in the soapstone industry. The management called a meeting



Colonel W. H. Sage, Jr., works manager

of the men and explained the situation, stating that two solutions were possible—either a curtailed production schedule or a wholesale layoff of employes. Without hesitancy the men voted unanimously for shortened hours, thereby permitting every man to retain his job even though they realized that their incomes would be reduced almost 50%. The people are thrifty. Their wants are few, although many now own automobiles.

The community is practically self-supporting. The company owns the Nelson and Albemarle railroad, the connecting link from Schuyler to the Southern at Rockfish and the Chesapeake and Ohio at Esmont. The N. and A. is a common carrier operating under the Interstate Commerce Commission. Virtually all traffic, however, is soapstone.

Young employes are apprenticed in whatever branch of the work seems most appealing to them. After several years' education in the practical school of experience these apprentices develop into skilled mechanics, electricians, machinists, carpenters, and miscellaneous soapstone workers. The present mill superintendent came up from the bottom by this route.

Little Formality Required by Management

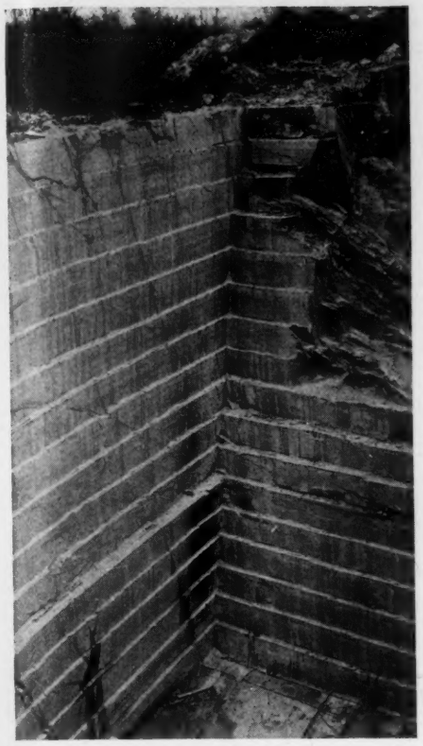
The informality at Schuyler is refreshing. The genial works manager, Colonel W. H. Sage, Jr., rules the community like a grand duke, yet even the lowest paid employe may walk into his office unannounced at any time, although the errand be no more important than to pass the time of day. Furthermore, he is welcome. This spirit undoubtedly is partly responsible for the morale of the men. The big boss is boss without any question, but he always has time to listen to their troubles on a basis of equality.

The company and its officials maintain the friendliest attitude toward the entire community. A large, thoroughly up-to-date school has just been completed to replace the one which burned a few months ago. Schuyler, of course, would have a school regardless of the Virginia Alberene Corp., but the efforts of the company have been directed toward teaching the parents to send their children and to keep them there as long as possible. The doctor, police force, and even the churches are under the watchful eye of the company, which also owns the store, one of the finest and best equipped general stores in the South. Unlike the condition existing

A. J. Belmore, general superintendent, at left and John Cartwright, quarry superintendent at right

in so many company-owned commissaries, there are no complaints against the store manager regarding either service or prices. A. J. Belmore, the general superintendent, is confidant and counselor for every man, woman and child in the community. During his 35 years at Schuyler he has been a sympathetic listener to innumerable tales of grief, marital strife, arguments, and possibly even feuds.

The "downtown" section of Schuyler, with hotel at right



One of the soapstone quarries near Schuyler

Group Life Insurance and Pensions

Several years ago the company decided to carry group life insurance on all employes. When the plan was first inaugurated many of the men resented it, believing that the officials would neglect safety precautions. They soon learned the value of this insurance, however, and now many of them carry the extra units provided for in the plan.

Pensions are handled in a distinctly unconventional manner. If the workman is alone in the world with no visible support and has served the company faithfully, he is liberally pensioned. On the other hand, if the individual retires when he has several stalwart sons still in the employ of the company, his pension will be meager. Each case is decided strictly upon its conditions and merits. This procedure certainly is not in agreement with the general attitude prevalent in this country, that a "corporation has no soul."

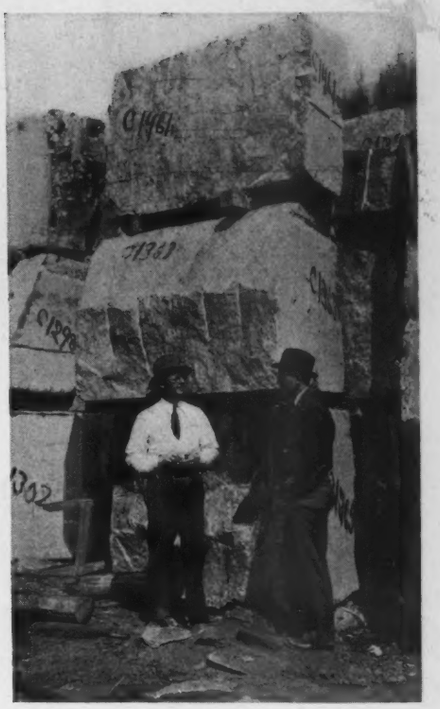
Visitors are welcome in Schuyler. The company is proud of its product and eager to demonstrate the processes of manufacture. The overnight guest is entertained at the combination hotel and boarding house which is on the brow of a hill overlooking the plant. There is plenty of good food cooked in southern style by a typical colored mammy who smilingly replied to an inquiry, "Yes, suh! Ah fixes everything we eats."

History of Soapstone

The earliest known products made of Virginia soapstone were the cooking stones and utensils used by the American Indians. This use led to the term "potstone." Early settlers in Virginia continued this practice, but actual commercial exploitation of the deposit began about 60 years ago, when laundry tubs were first produced at Alberene, Va. The present organization is a direct outgrowth of this humble beginning. Numerous other companies have attempted to develop soapstone deposits in Virginia and elsewhere, but none has survived. These failures apparently have been due to a combination of technical and economic difficulties.

John "Hardrock Charlie" Cartwright, the quarry superintendent, plans his development work far in advance. New quarries have been opened during the past few months regardless of the fact that soapstone production is below normal. These newly developed pits are kept ready for immediate operation in order to meet any unforeseen peak loads. The number of quarries being operated at any time depends directly upon the demand.

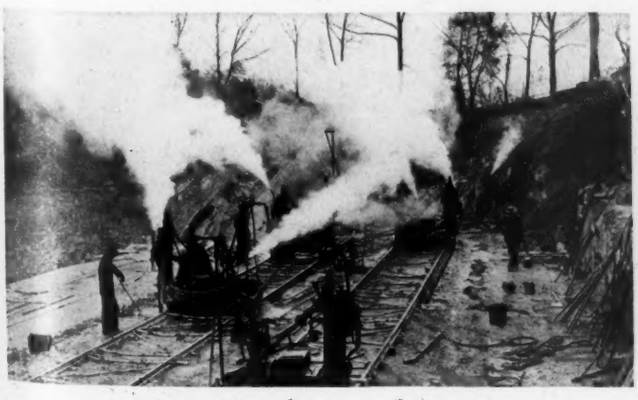
Dust mill at Damon, Virginia



E. L. Coleman, mill superintendent, left, and the author, with rough blocks in storage in the background

Local geologic conditions influence both the expense and the method of opening a new quarry. No explosives are used during either development or subsequent operations. Overburden customarily is removed by steam shovels and drag scrapers. Good soapstone may be found on the top floors of a new operation, but in many quarries the first seven or eight floors are waste. Disposal of overburden and waste stone is an important problem at Schuyler. Most of the waste material is dumped either in abandoned pits or along the right-of-way of the railroad. Dumps near present or future operations are undesirable, for the additional weight tends to aggravate the stress on the quarry walls.

Steam or electric-air channeling machines are used for all vertical cuts in the quarries at Schuyler. Reciprocating machines similar to channelers are used for most of the undercuts, although a Jeffrey longwall undercutter equipped with Stellite teeth is satisfactory



Channeling machines in operation

Opening a new quarry

for "soft" grade stone. The average size of the quarries is 100 ft. long by the approximate width of the dike, which normally varies from 100 to 120 ft. Pillars 22 ft. wide commonly are left between quarries, although the top five or six floors may be salvaged. The depth depends directly upon wall conditions. It varies from 150 to 200 ft., although the deepest quarry ever operated at Schuyler was 271 ft.

Soapstone Products

The soapstone blocks are roughly diamond-shaped, being split along the inclined grain of the rock. Their average size is 4x4x6 ft. or slightly larger. Each block is graded according to color, soundness and hardness, for its uses depend directly upon its properties. Swinging boom derricks are used to lift the blocks from the quarry floor either to cars or to storage piles. A large stock of rough blocks is kept in reserve. Each block is numbered, and a complete description of the properties and history of every block is filed in the office.

Battery of gang saws at mill

After being gang-sawed, the slabs are sent either to the stock mill or to the custom mill, both of which are supervised by E. L. Coleman. The output of the stock mill consists of standardized articles such as laundry tubs, sinks, and furnace blocks. Tub slabs are trimmed with a steel-toothed saw. Rubbing beds followed by carborundum groovers and smoothers prepare the parts for the assemblers. A recessed bolt in each corner and a cement made of linseed oil and litharge are used in assembling the tubs.

Furnace blocks, used in paper manufacturing plants, comprise an important part of the output of the stock mill. They are cut to size by a circular diamond saw.

All other soapstone is fabricated to blueprint specifications in the custom mill. The general procedure is similar to the stock mill except that carborundum trimmers are used rather than steel saws, and carborundum grinders supplement rubbing beds. The fabricated parts are assembled either at Schuyler or on location depending upon the nature of the job.

Talc Byproduct

Only about 20% of the quarry output emerges from the mill as finished product. A small part of the waste material is ground in a mill at Damon, Va., a short distance from Schuyler. A gyratory crusher, Allis-Chalmers ball mill and tube mills, Pennsylvania hammer mill, Hum-mer screens and air classifiers provide extreme flexibility of operation; 97% of the ultimate product is through 300-mesh. The rubber industry consumes a large quantity of a —40 - +48-mesh split.

The electric power situation at Schuyler is ideal. The company operates two hydro-electric plants utilizing local water power. When the local supply is inadequate, however, additional power can be purchased from the Appalachian Power Co. Furthermore, the old steam power plant at Schuyler is kept in shape for emergency operation.

Sold Under Trade Name

All soapstone produced by the Virginia Alberene Corp. is marketed through the Alberene Stone Co. under the trade name "Alberene Stone." The material has a variety of uses. Because of its complete chemical inertness it is widely used for laboratory equipment such as table tops, sinks, drain boards, gutters, fume hoods, shelving, floors and tanks. It also is used in acid and other chemical plants for vats, floors, shelves, wainscoting and other parts of the plant or equipment which are subjected to the destructive action of chemicals or fumes. Many dye tanks are made of soapstone. Other uses partially dependent upon its chemical composition are photograph, blueprint, x-ray and cardiagraph developing tanks; autopsy, mortuary and mausoleum slabs; and animal kennels, cages and other miscellaneous equipment for research laboratories.

About 40% of the soapstone produced at Schuyler is sold in the form of furnace blocks used for lining the furnaces of sulphate (kraft) pulp mills. Many of these blocks are exported to Canada to supply the Canadian paper industry.

Laundry tubs were first made about 60 years ago, but their production has declined tremendously during the past 6 or 8 years. At present they comprise only about 10% of the total output. Tubs finished in bright colors have enjoyed some popularity.

Soapstone now is being used for numerous architectural purposes, including sanitary partitions, shower compartments, sills, interior trim, wainscoting, spandrels and exterior trim. Harder grades are used for stair treads and floor tile. The high dielectric strength of soapstone makes it suitable for electrical switchboards, panels, barriers, bases, circuit-breaker compartments and related purposes. The early use of soapstone for griddles, fireless cookers, oven floors and grates, footwarmers, snow melters and hearths no longer is of any great importance, although it still is being used in commercial traveling baking ovens and electrical fireless cookers. When heated to a temperature of about 1800 deg. F. some grades of soapstone turn golden brown in color and become quite hard. Floor tile made in this manner has attracted some attention. Similarly treated, soapstone dust appears to be a satisfactory abrasive.

The markets for soapstone are world-wide, but actual sales are confined principally to areas within reasonable shipping distances of Schuyler. With the exception of furnace blocks, exports and imports never have been of any consequence. Although "Alberene Stone" at present meets no competition from other soapstones, it is the basis of a highly competitive industry, for all uses are in direct competition with numerous other products. To the residents of Schuyler and its vicinity, however, soapstone ranks far above all other mineral commodities in world importance, for it dominates their lives and controls their very existence.

Fluorspar

FLUORSPAR shipments in 1930 to the steel and foundry industries fell off 36%. Shipments to cement plants, however, increased a small amount. Shipments to the ceramic industries during 1930 fell of 45%.

Following are the tonnages and value of fluorspar shipped from mines in the United States for the years indicated, according to the United States Department of Commerce, Bureau of Mines, reports:

Year	Short tons	Value	Value per ton
1926	128,657	$2,341,277	$18.19
1927	112,546	2,034,728	18.08
1928	140,490	2,656,554	18.90
1929	146,439	2,791,126	19.06
1930	95,849	1,746,643	18.22

Canadian Rock Products Developments

By W. B. Lenhart
Associate Editor, Rock Products

PROBABLY the most popular topic of conversation in Canada today, as well as in this country, is unemployment. In certain sections of the Maritime Provinces every effort is being made to employ as many men as possible on public improvements, there being a decided tendency to use hand labor to the exclusion of mechanical methods. This may work out satisfactorily for some types of construction work, but for highway paving, grading, etc., it certainly has few merits.

Highways Needed

Canada needs highways badly, having vast areas that are served by poor roads. Further, the Dominion does not have a transcontinental East-West highway at all, and a trip across Canada in an automobile is practically impossible.

Thus, with a crying need for good roads, it would appear that where a dollar is to be spent it should be spent so as to get the most good for the spender. This would automatically help relieve the labor situation. It is granted that more hand labor is necessary to build a mile of road than where modern methods are used, but the point I am trying to make is that they could employ the same number of men as they do now, give them modern tools to work with, and get three or four times as many miles of needed road, with practically the same expenditure.

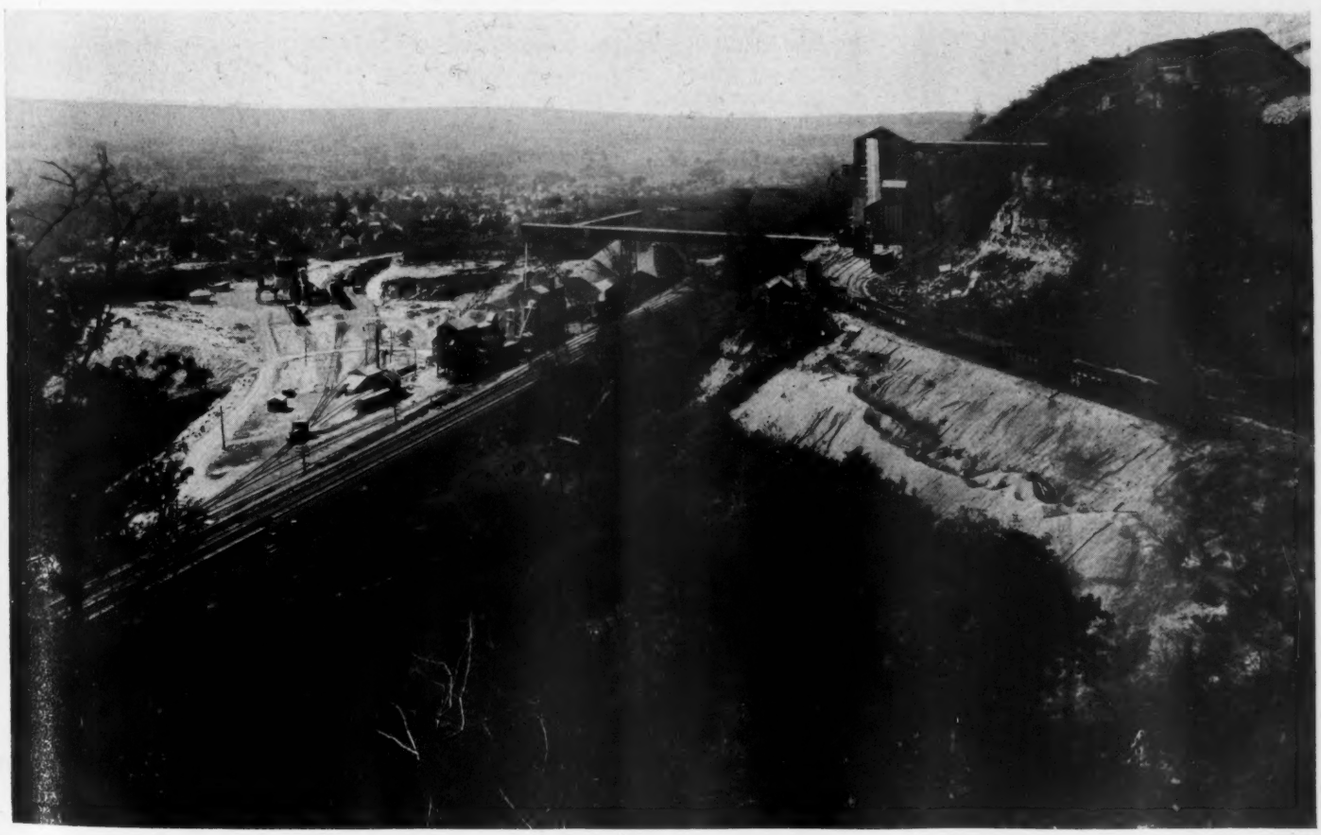
In driving from Sault Ste. Marie, Ont., to Montreal, Que., by way of Sudbury and Pembroke, Ont., the road is for the most part just a good wagon road and compares in no way with the graveled and graded roads that we have in Nevada, New Mexico, Wyoming and other of our sparsely populated states. Along this road were many groups of laborers attempting to straighten, relocate or regrade the present route, the greater part of the work being done by hand labor, with wheelbarrows or teams. It was explained that some of this was of a local nature and to relieve local unemployment.

Canada has adopted a sort of slogan, "Canada for the Canadians," and backed it up with a tariff wall that excludes States-made machinery, so that many manufacturers have established fabricating plants in Canada to supply the need for Canadian-made machinery. These factories employ thousands of skilled and semi-skilled laborers, salesmen, office staffs, etc. Are not these men entitled to a fair share of the funds that are being spent for highway building?

Possible Transcontinental Highway

There is considerable talk of constructing a paved highway across Canada which would probably connect with the paved road at Pembroke, Ont., and follow the present road to Sault Ste. Marie, thence to Port Arthur and westward to Winnipeg. At present there is no road from the Soo west, the traveler having to cross into the United States and follow the south shore of Lake Superior until he can return to Canadian soil via Duluth.

To build this highway would be a big undertaking for the Dominion, but there are many places in the States where graded and paved roads have been built under as difficult conditions as this one would be. Modern equipment would put the road through, whereas if the policy of employing hand labor alone is pursued, a lifetime would pass before such a road would be a reality. This tendency to insist on employing a maximum



Dundas, Ontario, plant of the Canada Crushed Stone Co., Ltd.

number of men, it was said, has in several cases seriously affected the business of some of the Canadian contractors.

Construction of such a highway would stimulate all of the rock products industries in Canada and give the Canadian machinery manufacturer a chance to sell his wares. It probably would put the crushed trap rock plant at Bruce Mines, Ont., formerly the Dominion Trap Rock Corp., into production again. This company stopped production two years ago mainly because the newly opened trap rock quarry was not trap rock but more of a schist. However, two to three miles from the present plant is an excellent grade of hard trap rock that the company owns. The tariff on trap rock brought into the States also was a factor in terminating the operations of this company. The company is now owned by United States capital.

Might Use More Cement

Canada produces little or no asphalt, and hence nearly all bituminous materials must be imported. It would seem that if the Canadians were in earnest about the slogan, "Canada for the Canadians," they would use more Canadian-made cement for highway construction than they now do.

Many crushed stone operators have asphalt mixing plants as part of their operations. One operator installed a paving plant in the Hagersville district in connection with his crushed stone operation (Gordon Crushed Stone Co., Ltd.). The Villeray Quarries Co., Ltd., at Montreal, completed and placed in operation its new paving plant that was referred to in the October 25, 1930, issue of Rock Products.

The Ontario Ready Mixed Concrete Co., with plants at Montreal, Toronto, Ottawa and Niagara Falls (Ont.), recently undertook a novel step in the development of ready-mixed concrete by taking a contract to construct nine miles of 20-ft. highway in the Province of Ontario far removed from the industrial and thickly populated sections. The company installed a semi-portable sand and gravel washing plant and used the "Transit" mix system for preparing and delivering the concrete.

Transit-mix trucks of the Ontario Ready Mixed Concrete Co. delivering concrete to a rural paving job

Another new company started in the ready-mixed concrete business this year at both Toronto and Montreal. This company, the Dual Ready Mixed Concrete Co., uses the Jaeger mixer trucks. This company is a subsidiary of the Dufferin Paving Co., which, in turn, owns the Hagersville Quarries, Ltd., at Hagersville, Ont., the National Quarries, Ltd., at Montreal, Que., and other aggregate producing operations in Canada.

The Canada Cement Co. continues its program of changing its producing plants from the dry to the wet process. The Port Colborne plant is the latest one to undergo alterations of this nature. Incidentally, the company is installing the longest rotary kiln in Canada—420 ft. long. This work is being done under the direction of F. L. Smidth and Co., New York City. At the Hull plant the raw grinding plant has been rearranged so that the mills are each driven by a 150-hp. motor through a Kennedy-Falk gear reduction unit.

Quarry of the Hagersville Quarries, Ltd., at Hagersville, Ontario

New Lime and Gypsum Plants

In the high calcium lime producing district at Beachville the Gypsum, Lime and Alabastine, Canada, Ltd., made improvements at its lime plant, having installed a 30-in. gyratory crusher as a primary unit. Hand loading in the quarry was replaced with shovel loading and motor truck transportation. Two 7½-yd., side-dump Mack trucks with Easton type bodies are now used for hauling the stone to the primary crusher. The coarse stone from this crusher, after screening out the fines, is used for kiln stone. The fines are sold locally for road building and other purposes. Also the kilns have had an additional 5-ft. extension built on their tops.

At Ingersoll, a short distance west of Beachville, Ont., the Innerkip Lime and Stone Co., Ltd., went into production recently with a new lime plant. This company, headed by C. N. Downing, who formerly controlled the operations now owned by the American Cyanamid Co. at Beachville, Ont., installed two 30-ft. Arnold and

Weigel coal-fired kilns and is shipping lump lime to Canadian users. No hydrating or pulverizing plant is at the operation nor does the company quarry its own stone, but purchases high calcium limestone from the Beachville quarries.

Later the company expects to open its own quarry near the kilns.

The Canada Gypsum Co., Ltd., the Canadian subsidiary of the United States Gypsum Co., has just completed a new calcining and wallboard plant at Hagersville in eastern Ontario.

The company, after prospecting the district, centralized its activities at Hagersville and made extensive core drilling to determine the size and nature of the deposit before starting construction of the new unit.

A three-compartment, vertical shaft, concrete lined, was sunk in the gypsum veins to a depth of roughly 100 ft. Some of the equipment installed is from the old plant of the Niagara Gypsum Co., Buffalo, N. Y. but with the addition of several modern features. No conveying or elevators are used in the plant for handling the finely ground materials, this work all being done by airveyors. Calcination will be done in a rotary kiln with coal for fuel.

A second new plant is to be constructed in Nova Scotia. This program, with the Hillsborough, N. B., operation acquired from the Albert Manufacturing Co., will give the Canada Gypsum Co., Ltd., a considerable Canadian production.

New plant of the Canada Gypsum Co., Ltd., near Hagersville, Ontario

Crushed Stone Situation

The Canada Crushed Stone Co. at Dundas, Ont., expects to open up its new quarry some time this year. This deposit of limestone is about two miles from the Dundas plant and the company expects to purchase haulage equipment of sufficient capacity so that one train of three cars will deliver around 75 tons per trip. It is expected that four trains will be in use.

As electric power is cheaply obtainable from Niagara Falls, the company expects to use an overhead trolley for its transportation system.

Ballast shipments from the Ontario producers were practically nil during this year. Some of the plants shipped up to July 1, after which time shipments were held up by the railroads. The Belleville plant of the Canada Cement Co., usually a large ballast shipper, practically ceased shipments of ballast after early summer. The Deeks operation of the Greenville Crushed Stone Co. had a short operating season this year, as did also its Hawk Lake, Ont., plant. The Canada Crushed Stone Co. at Dundas made some shipments of ballast this year.

Prices for crushed stone in the Montreal district were said to be very low. Some producers had borrowed heavily from the banks on their stocked material, and this summer the banks began to pinch down on these loans so that producers had to dispose of their stockpiles at a great sacrifice. This helped to demoralize the already shaky market in this area so that crushed stone could be purchased in Montreal for almost the haulage charges.

New lime plant of the Innerskip Lime and Stone Co., Ltd., near Beachville, Ontario

Canadian Gypsum Manufacturer Markets New Lightweight Building Product

CELLULAR BUILDING MATERIALS will be produced and made available in Canada for the first time by Gypsum, Lime and Alabastine (Canada), according to R. E. Haire, president of the company. This development follows many tests and special Canadian machinery is to be used for the process of mixing in the heavy foaming compound which gives the cellular structure to the materials.

Cell concrete, cell lime and cell gypsum are the materials mentioned, none of which have been commercially available in Canada until now. They will be adaptable to practically any type of construction and cell concrete, especially, it is stated, will find a wide field for service. This material, which can be varied in weight from 14 to 140 lb. per cu. ft. containing between 100,000,000 and 200,000,000 air cells, has high insulating value against heat, cold, sound and fire, and for skyscraper construction its variable but predetermined weight adapts it for certain types of wall construction, floor and roof fills where lightness must be considered as well as essential qualities.

Plants of Gypsum, Lime and Alabastine in Vancouver, Calgary, Winnipeg, Caledonia, Toronto, Montreal and the Maritime Provinces are to be affected by the development. For cell gypsum and cell lime, the company will use products of its own mines and arrangements have been made with the Canada Cement Co., Ltd., for the cement required for cell concrete. Special machinery can be readily taken to the construction job for either casting or pouring the material into forms.—*Financial Post* (Toronto, Ont.).

Gravel Plant Adds Equipment

THE Blue Point Gravel Co., near Smartsville, Calif., is reconditioning the dam and has ordered some new machinery to be placed at its Blue Point gravel pit where there is much gravel to be taken out.

Cement Plant with Interesting Control of the Raw Mix

Southwestern Portland Cement Co., Victorville, Calif., with Raw Materials of More Than Usual Variation Maintains Uniformity and Quality by Careful Control Which Begins in Quarry

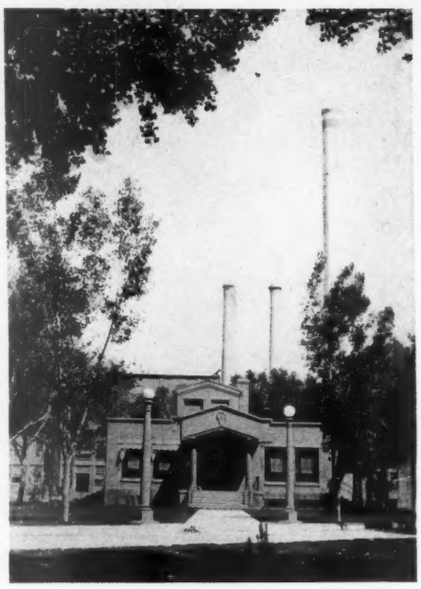
TAKING its raw materials from the hills of the Mohave Desert, the Victorville plant of the Southwestern Portland Cement Co. controls the mix and blends the different raw ingredients in an interesting way.

The cement is made from a mixture of four raw materials: limestone, shale, lime garnet and silica, each somewhat variable and occurring in large deposits. Five quarries have been operated and a sixth has been drilled for quarrying, all adjacent to each other and about seven miles from the mill. These deposits are of both high and low lime content with variable amounts of garnet and silica. The sixth quarry is being opened to gain a new high lime deposit and incidentally to shorten trackage and rail connections by eliminating switch backs.

The lime garnet encountered in these deposits is a silicate of Ca and Al with iron and silica but without the usual amount of CO_2 present in limestone. A typical analysis is:

Si	34.6
Al	18.8
Fe	5.4
CaO	35.0
MgO	1.7
Ignition loss	5.2

In addition to the limestone and lime garnet there are deposits of quartz or silica at a lower level and also adjacent deposits of shales and clays with high and low iron content. These various raw materials permit of blending in practically any proportions desired. The garnet is added to make up a certain per cent. of the mix because it gives easier fusibility and because it permits a higher lime content without having free lime in the clinker and gives higher strengths.



Office and grounds with plant beyond

Control begins with the drilling in the quarry, the drill-hole bailings being sampled and analyzed every 5 ft. of depth and a record kept so that the shovel operations may be intelligently directed toward getting the desired materials to the mill as needed for proper combination.

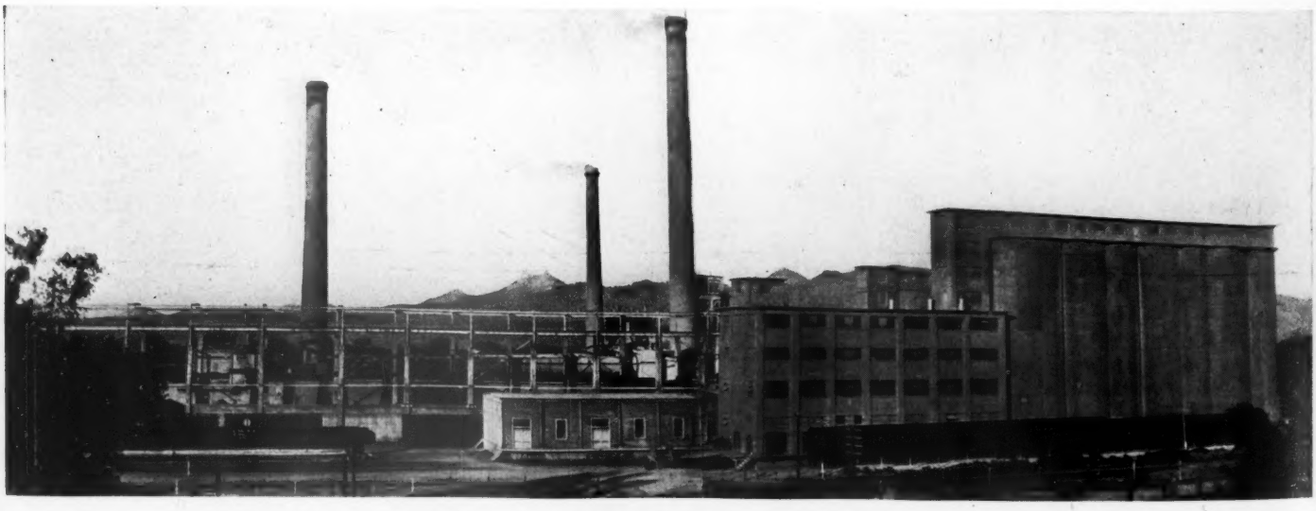
Quarrying

Drilling is done by motor-driven Armstrong drilling rigs using 5⅝-in. bits. Excavating and loading is done normally with two electric shovels, one a 125 Marion with direct-current motors, and the other an 80-B Bucyrus shovel with 3-yd. bucket and using the Westinghouse alternating-current system with transformers and slip-ring motors with contactor switches. Additional Marion steam shovels are available for emergency or greater output.

The broken rock is transported from the quarry to the mill over a standard gage railway line in cars arranged with three hinged skips to carry 30 tons of rock per car. These cars are handled in seven-car trains by three 60-ton Davenport and one 40-ton Porter saddle-tank steam locomotives.

Crushing and Raw Grinding

At the mill the rock is dumped to a 48-in. by 60-in. Allis-Chalmers jaw crusher, then passed through a Jumbo Williams pulverizer and elevated and conveyed to the ground storage pile where it is placed in one of three piles by means of a belt conveyor tripper. Two tunnels below the ground storage permit reclaiming from any point onto belt conveyors and the material



General view of plant of Southwestern Portland Cement Co. at Victorville, Calif.

One of the quarry operations

A closer view of the same quarry

is then elevated and carried to the various feed hoppers above the raw grinding mills by belt conveyor and tripper.

Four 7-ft. by 26-ft. two-compartment compeb mills and one 7-ft. by 40-ft. Traylor three-compartment mill are used on the raw end. A double-unit Hum-mer vibrating screen and Wilfley pump have been installed in closed circuit on the first compartment of the No. 4 mill.

The slurry going to each tank is sampled and analyzed hourly in order to determine whether the tank will be high or low lime and each tank is then analyzed as a whole and they are combined as necessary to give the desired kiln feed. Six to eight tanks are connected together to supply the kiln feed, while sixteen tanks are used altogether for handling the slurry, each with a capacity of about 750 bbl.

An interesting feature of the control at this point is the sampling of the kiln feed and the burning of the sample in a small laboratory furnace as a check on the calculations. A 4-gram sample of the slurry is taken periodically and is clinkered in the furnace and then analyzed. The clinkering is accomplished in about 6 min. in a platinum crucible in a small gas-fired furnace which was designed and built by the company's own organization. In this way a quick and accurate check is made so that the feed may be changed or corrected if desirable before any considerable amount has been burned.

As a matter of routine the finished cement is, of course, also analyzed and samples of all shipments are kept in tin cans for several months.

Because of the nature of the garnet the lime content cannot be determined by the usual acid-alkali method used for limestone but is determined by calculation and titration with potassium permanganate.

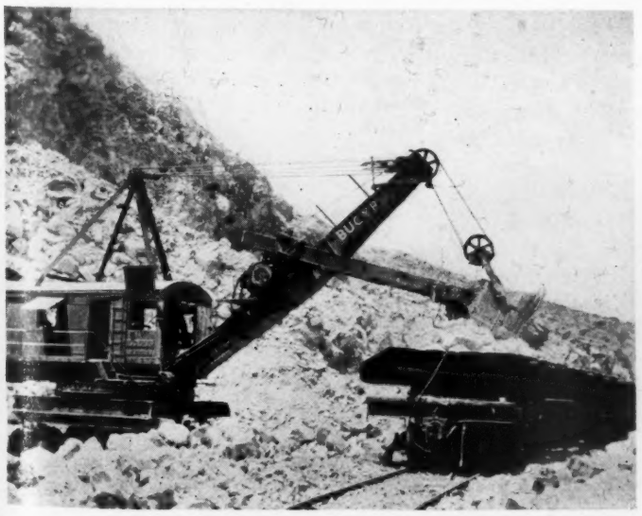
Burning

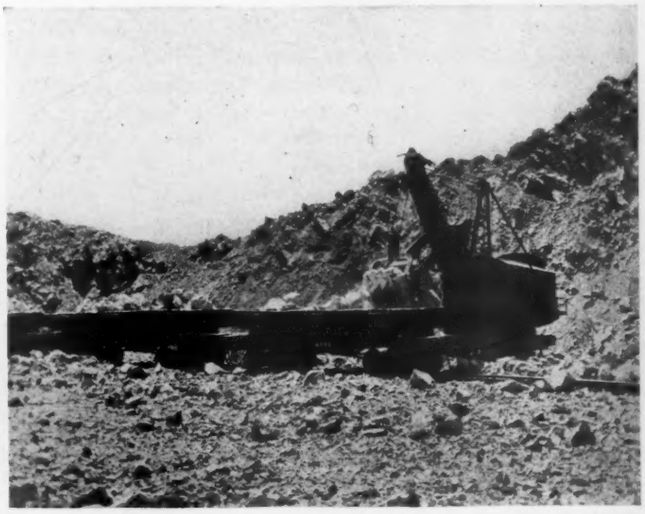
Burning is done in five kilns: two of these are 9 ft. diam. by 200 ft. long; two are 9 ft. diam. by 200 ft. long with a 10½ ft. diam. enlarged zone; and the last to be installed in 1926 is 10 ft. diam. by 200 ft. long with a 13 ft. diam. enlarged zone. These are all oil-fired. Chains have been installed in one kiln and are also being installed in a second one, with a resultant fuel saving of about 15%.

Drag chains were previously used to handle the clinker to storage but five 8-ft. by 90-ft. rotary coolers were later installed. A German reciprocating type conveyor known as a "torpedo" conveyor is used to handle the clinker from the coolers to storage. This extends along the discharge ends of the coolers and carries the clinker over to a bucket elevator alongside the storage yard. The material has a travel of about 9 in. at each stroke and the conveyor is driven by a 7½-hp. motor, making a very simple and economical rig.

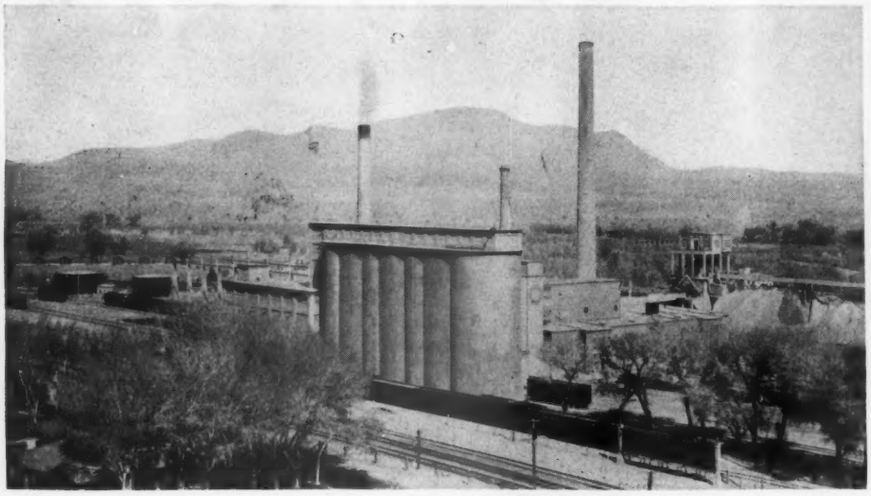
Finish Grinding

The clinker is handled by an overhead traveling crane and clamshell bucket from storage to a hopper at one end of the storage yard from which it is elevated and





Two views at one of the other operations showing electric shovel loading to skips on standard gage cars



Another view of the Victorville plant

passed over a Hum-mer vibrating screen equipped with ½-in. mesh cloth. The oversize falls to a set of Buchanan rolls and the fines are carried to the feed hoppers over the grinding mills.

The same number of mills of the same general size and type are used as for the raw grinding, these having been furnished by the Allis-Chalmers Manufacturing Co. Air separators are being arranged to work in closed circuit on the first compartment of the mills and a 16-ft. Sturtevant air separator is being used with the one large 7-ft. by 40-ft. mill. The cement is ground to 94% through 200 mesh.

In addition to standard portland cement, hydro-plastic cement and special oil-well cement are also made, the latter having the property of hardening more quickly and with more water than standard portland cement, and being used to meet unusual conditions in oil field work where it must be placed at depths as great as 8000 ft. and under temperatures up to 212 deg. F. The hydroplastic cement has of course much greater plasticity and workability than the standard cement.

The plant was fully described in Rock Products, September 15, 1928. L. V. Robinson is superintendent at Victorville and R. M. Willson is chief chemist.

The Mineralogy of Cement

THE growing importance of mineralogy in the researches into the nature of portland cement is shown by A. C. Davis, works managing director, Associated Portland Cement Manufacturers, Ltd., in a recent issue of *Cement and Cement Manufacture,* London, England.

According to Mr. Davis, the usual methods of chemical analysis do not of themselves show whether a cement is good or bad, since it is not difficult to prepare a material having the exact constituents of portland cement but with no cementing properties whatever. However, the petrographic methods of mineralogy are proving a valuable aid in carrying on these investigations. These methods consist of examining thin sections of cement clinker under the microscope with the aid of polarized light.

In this way several minerals have been recognized in cement clinker: particularly, alit, which is a solid solution of tri-calcium aluminate and tri-calcium silicate; and celit, which is a solid solution of di-calcic silicate and di-calcic aluminate. These are soluble in each other in all proportions in the fused state, but when cold the mixture splits up into alit and celit, each of which has the properties of a true cement. In order that both may be present, the composition of cement must be between the following limits: silica, 18.5 to 23.2%; alumina, 6.1 to 11.9%; lime, 63.1 to 68.1%.

In practice, cements are not fused but are formed by the diffusion of one solid into another at a temperature below their fusion point, this diffusion being more rapid the higher the temperature. The time required for it also depends upon the surface area of the particles, so that the finer the raw materials are ground the more readily is the diffusion accomplished. However, too high a temperature and too rapid cooling must be avoided or an unstable clinker may result.

Cement Composed of Several Minerals

From mineralogical studies it seems clear that portland cement has no fixed constitution and is not a homogeneous body but is composed of at least five portland cement minerals. Four of these are crystalline and are known as alit, belit, celit and felit, while the fifth is amorphous. It is assumed from the investigations made to date that differences in the composition of alit probably account for variations in the time of setting and strength of cement.

Examination under the microscope permits clear and well defined identification of the various minerals making up portland cement and in the study of the effect of various combinations.

X-ray Studies Show Composition of Cement Clinker

The x-ray has been used in recent research into the composition of portland cement clinker, and it has been possible in that way to show that tri-calcic silicate exists and can be formed from a mixture of lime and silica. It has also been shown that lime does not enter into solid solution with di-calcium silicate in appreciable amounts, but that under certain conditions a mixture of tri-calcium silicate and either alpha or beta di-calcium silicate results.

Free lime was not found in commercial cements by the x-ray method, but investigation of the identification of lime by this method indicates that 2.5% is recognizable; hence, it appears that free lime is not commonly present in commercial cements in amounts as high as 2.5%.

The minimum amounts of the cement compounds that could be detected in controlled laboratory clinkers by the x-ray method were as follows:

	Per cent.
Tri-calcium silicate	8
Beta di-calcium silicate	15
Tri-calcium aluminate	6
Tetra calcium alumino ferrite	15
Magnesia	2.5
Lime	2.5

Cement clinkers, representing many types of raw material and processes of manufacture, were submitted to x-ray examination, and tri-calcium silicate and beta calcium silicate were identified in each as unquestionably the most abundant constituents. Tri-calcium aluminate, tetra calcium alumino ferrite and magnesia were identified, separately or together, in most of the clinkers, but in many of them the patterns of one or two of these latter compounds were not observed.

The results obtained in this investigation by x-ray methods are in agreement with those obtained by chemical and microscopical methods, and each serves to support and confirm the other. The collective results may be said to define the major constitution of portland cement clinker. They indicate:

(1) That the most abundant constituents are tri-calcium silicate and beta di-calcium silicate.

(2) That there are normally present, in addition, tri-calcium aluminate, tetra-calcium alumino ferrite and magnesia.

(3) That free lime is not normally present in amounts as great as 2.5%.

New Light on the Grading of Aggregates

Reviewed by Edmund Shaw
Contributing Editor, Rock Products

PAPERS by C. C. Furnas* and F. O. Anderegg† (*Industrial and Engineering Chemistry* for September) review the work of these investigators in the grading of concrete aggregates. Previous investigators, Feret, Fuller, Talbot, Graf, Abrams and others, have studied grading empirically, selecting the best grading from a number of tests, but in Prof. Furnas' paper the grading for maximum density is found by mathematical analysis. Mr. Anderegg's work has been a confirmation by experimental studies of gradings made in accordance with the equations developed by Prof. Furnas.

Prof. Furnas assumes that the most desirable grading is that which will give a mixture of maximum density, since it will require the least cementing material. Workability is not considered in the first of his studies, and it is admitted that the mixtures obtained would be so harsh that they could not be placed without some effective method of vibrating which would settle them in the molds. In the second part of his paper he takes up continuous gradings, which he says are workable, because in such gradings the particles act as ball bearings.

Since the paper is a mathematical study, there are many equations, and it is impossible to give the full reasoning without reproducing them. So this review will give the results and only a little of the methods by which they were obtained.

In previous work, Prof. Furnas showed that when two sized components are mixed to obtain the greatest density the ratio (Z) is $\frac{1}{1+V}$, where V is the fraction of voids in the uniformly sized particles. (Thus if the voids were 60%, or 0.60, the amount of the largest pieces, in absolute volume, would be 0.625 or 62.5%.) This is theoretically true only when the particles pack as though they were infinitely small, but the equation has been found valid when the ratio of small to large is as much as 0.2.

Calling the absolute volume of large Z, the volume of the fines to fill the voids in a unit volume would of course be $1-Z$. And if still finer material were used to fill the voids in these fines the amount would be

$$(1-Z)\left(\frac{1-Z}{Z}\right),$$

and so on with smaller sizes to form a geometrical progression. The ratio between the term is $\frac{(1-Z)}{Z}$. But since Z equals $\frac{1}{1+V}$, this ratio is equal to V. Hence the total volume of solids in a mix of maximum density may be written as:

$$\text{Total absolute volume of solids} = \frac{1+V+V^2+V^3\ldots.}{1+V}$$

The summation of this equation may be called S.

If it is assumed that the sized materials are placed in layers, the volume of the entire bed would be:

$$\frac{G_T}{G_a}S$$

G_T is the true specific gravity of the materials and G_a is the apparent specific gravity of the bed itself. If the layers are now mixed together the volume will decrease because the fines will go into the voids between the larger pieces, as everyone who has mixed aggregates knows. It is plain that the difference in size will affect the amount of shrinkage on mixing, for if there is no difference in size the bed will not shrink at all. But if one of two components has particles of very small size all the particles will go into the voids between the large particles and the volume will be that of the layer of large particles, taken as 1. Hence the shrinkage in volume may be expressed as a factor varying between 0 and 1. This factor is called y.

The mathematical method of finding a value for y is long and complicated, but the results are given in graphical form in Fig. 1. It shows that as the difference in size between the fine and coarse particles increases the value of y increases regularly from 0 to 1. The ratio given in the horizontal figures is not the ratio between the fine and coarse but between two adjacent sizes, which makes the equation general. K is the ratio between the largest and smallest sizes and n is the number of sizes used.

In Fig. 2 the figures on the horizontal line do represent the ratio between the largest and smallest particles and the vertical figures are the *number* of components that will give maximum density. This is all derived from equations previously given, but they are too many and too involved to reproduce here. But this Fig. 2 has a practical value. An example is given for working out the densest mix for concrete using 2-in. stone, and cement with 0.001-in. average diameter by its use. The sand size works out to 14-mesh and the mix to 1:2:5.

Such mixes of one-size components, fortunately for the aggregate producer, are almost never used in practice. But the value of all this work is that it is necessary to find the principal equation for continuous grading. In this it is assumed that there must be some ratio in the volume of one size to the volume of the next size. This ratio is called r and its volume has been found to be:

$$r=\frac{1}{V^{n/m}}$$

In this V is the voids in uniform material, n is the number of components for maximum density as shown in

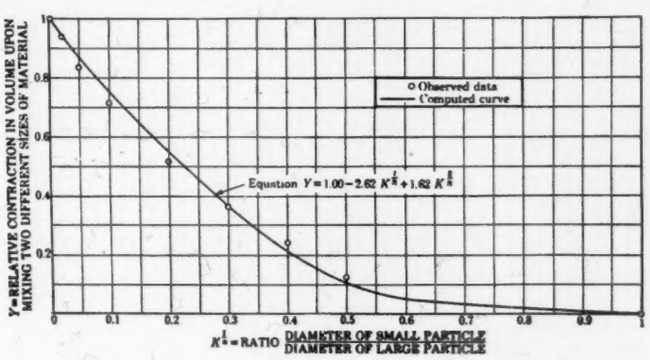


Fig. 1. Relation between size ratio and contraction in volume in mixing to maximum density

Editors' Note

MR. SHAW has packed a large order in a small space here. Prof. Furnas' paper is an involved mathematical analysis and probably could not be followed very easily by most of us who have been out of school for a number of years. The purpose of it is practical, as Mr. Shaw has brought out.

Dr. Anderegg's paper brings out experimental proof of Prof. Furnas' mathematical analysis and gives some ideas of its practical application to mortar mixtures. The two papers together represent the most scientific and uptodate effort to arrive at a perfect grading for aggregates so far as density is concerned.—The Editors.

*Formerly with the U. S. Bureau of Mines and now with the department of chemical engineering, Yale University. The paper was published by permission of the director of the U. S. Bureau of Mines.

†Contribution from the Portland Cement Fellowship, Mellon Institute, Pittsburgh, Penn.

Fig. 2 less 1, and m is the number of screens used less 1, the ratio of screen openings being $\sqrt{2}$. If, for example, the voids were 40%, the number of components from Fig. 2

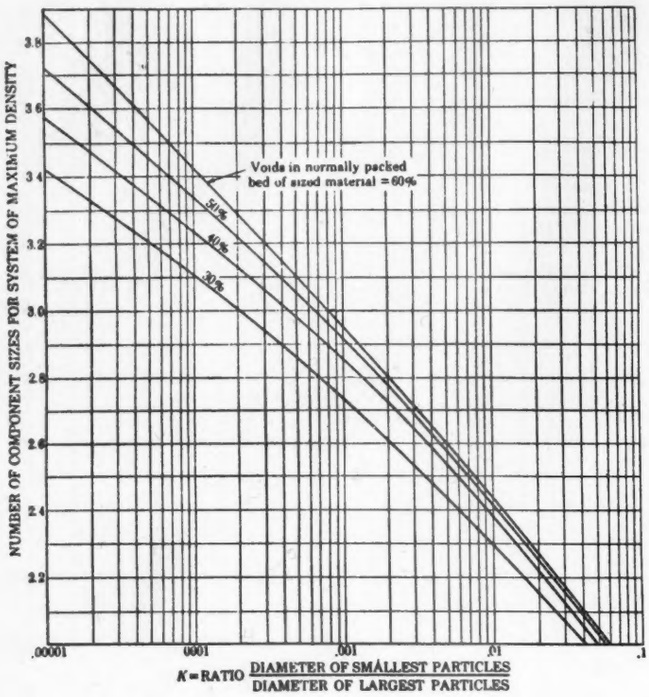

NUMBER OF COMPONENT SIZES FOR SYSTEM OF MAXIMUM DENSITY
Voids in normally packed bed of sized material = 60%
50%
40%
30%
K = RATIO DIAMETER OF SMALLEST PARTICLES / DIAMETER OF LARGEST PARTICLES

Fig. 2. Relation between size ratio and number of component sizes for systems of maximum density

was 2.45, and the number of screens 15, then:

$$r = \frac{1}{V^{1.45/14}} = \frac{1}{0.91} = 1.10$$

This value of 1.10 means that if 1 lb. of the smallest size was taken, 1.10 lb. would be taken of the next size, 1.21 lb. of the next, and so on. The ratio used in this calculation for finding n was 128 (this would correspond to 65-mesh and 1-in. sieves on the Tyler scale or about No. 70 and 1-in. on the U. S. scale).

Curves have been plotted on both logarithmic scale and linear scale graphs and are reproduced here.

It is to be noted that the value of r will vary with the voids. For voids of 30, 40, 50 and 60% the corresponding values of r are 1.12, 1.10, 1.075 and 1.058. According to the paper there is no single curve that is sufficient for all classes of material. Each must be worked out from the equation for r given.

Applications of the Formulas to Mortars

In his paper F. O. Anderegg points out that for practical purposes r should represent the ratio of the quantity left on one sieve of a series to the quantity left on the next sieve. Thus r would vary with the ratio of sieve openings. Values of r are given in the paper for the sieves used in finding the fineness modulus, which have a ratio of 2 and also for the Tyler series the sieves of which have a ratio of $\sqrt{2}$. These were tested by packing lead shot, iron shot and sands in containers. In one test it was found possible to put cement equal to one-third of the weight of standard Ottawa sand with the sand without forcing the grains apart, the voids in the sand being 38%. In general these packing tests confirmed the theoretical work of Professor Furnas on both intermittent and continuous grading of aggregates.

Mortars were made with graded sands and tested for strength, resistance to chemical action and other qualities; and in these the results were in accordance with the formulas.

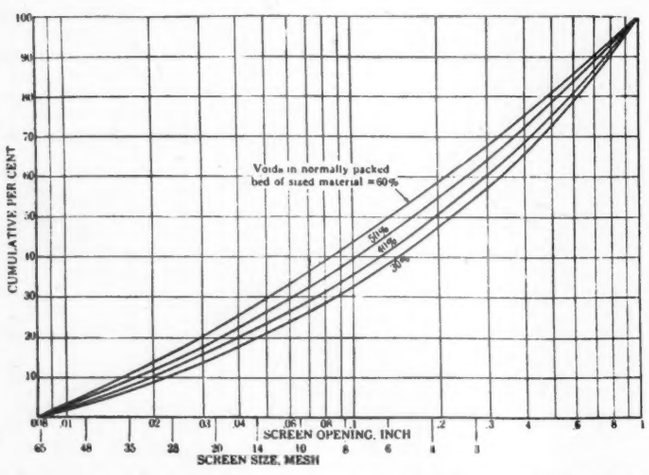
Experiments with cement and Ottawa sand developed that it is hardly fair to judge all cements by mortars made with this sand, for some gave higher and some lower strengths than when tested with ideally graded sand. A standard testing sand was worked out with such grading that r equals 1.11, made from run-of-mine and other grades of Ottawa sand.

The results on mortars made with continuously graded sand tend to confirm the work of Graf, whose best grading curve has a value for r of from 1.11 to 1.18.

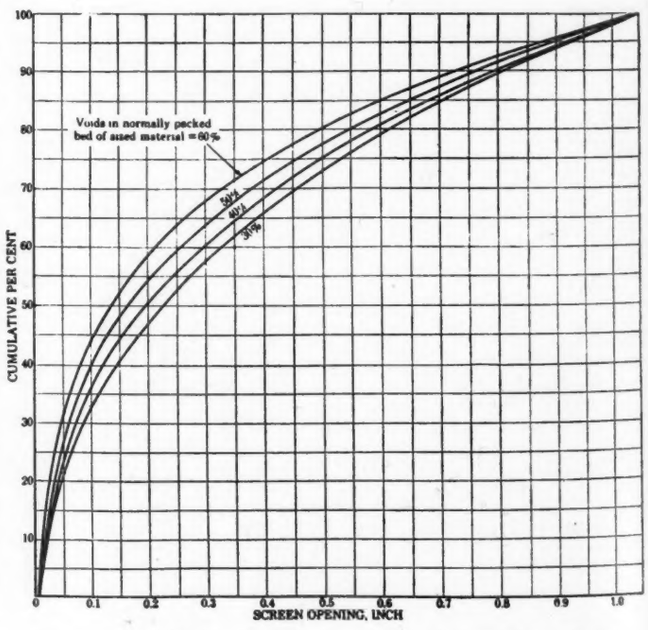
In work on commercial stuccos it was found that two factors contributed to workability, the water requirement and the grading of the aggregate. The first depends on the amount of fine material. As to grading, those stuccos in which r had a value of about 1.1 gave the best results. Panels of these stuccos weathered and crazed very little when tested by exposure. With other panels that did not stand so well part of the trouble was ascribed to humps in the curve of the grading of the aggregate.

For mortars the continuous grading gave good workability, low water requirement and great compactness with high strength, low absorption and low shrinkage. Best results were with values of r from 1.10 to 1.12. With the sieves used for finding the fineness modulus the ratio is about 1.20.

The effects of humps in the grading curve were studied by adding sized sand to the continuously graded sand. Additions up to 20% resulted in strength diminutions up to 65%, the addition of finer sizes causing the



Computed relation between screen size plotted on logarithmic scale and cumulative per cent. for beds of maximum density



Computed relation between screen size and cumulative per cent. for maximum density

greatest loss. Other properties than strength were adversely affected.

The rational application of continuous grading would include the cement as well as the sand. It was found that some cements have humps in their grading curve which must presumably lower the strength when these are used in mortars. The defect can only be overcome by better or more scientific grinding and grading of particle sizes.

Most natural sands contain more 30-50-mesh material than is needed for high grade work. The addition of fine crushed rock to the lower part of the grading curve will often be economically justified.

Cement admixtures are helpful in so far as they bring any part of the sand-cement system closer to the ideal.

Deleterious Substances in Aggregates

"THE WORD deleterious as applied to gravel aggregate has caused many a quarrel," says F. C. Lang in a recent article in the *National Sand and Gravel Bulletin*. "It is my thought," he continues, "that we should omit the word deleterious and any attempt of enumerating the objectionable substances, and instead should have definite tests with suitable test limits based on the behavior of these particles."

He discusses the current specifications and seems to agree that most of them are "rule of thumb documents based on engineering judgment of local conditions," as Committee E-5 of the American Concrete Institute has said.

He believes that all objectionable substances in gravel pebbles can be divided into (1) those having volume change and (2) those structurally weak. In the first class are shales, a material which he calls "chocolate bars" but does not further define, some cherts and the like. These expand with such force that they may blow out the concrete that lies over them or may cause the total disintegration of the concrete if they are in sufficient quantity. The second class would include pieces which are weaker than the surrounding mortar and those having adherent coatings.

Research has been carried on by Mr. Lang and Prof. Hughes of the University of Minnesota, for the university and the Minnesota Department of Highways. This is to develop tests and to set test limits for the various uses for which concrete is designed on the basis of strength and exposure. Admittedly this is a big job, but Mr. Lang believes that the principle is so fundamentally sound that both producers and users should favor it.

Tests of substances of the first class were made with the dilatometer, a tight metal container into which the substance to be tested is placed and covered with water. A long tube extends from the top of the container and the expansion and contraction are measured by the rise and fall of water in this tube. There is, of course, an expansion on freezing. If the volume returns to the original point on thawing, then there has been no expansion of the substance. A sample of sandstone tested in this way showed no volume change after freezing and thawing, but a sample of chert which was frozen and thawed three times showed an increase in volume after every cycle. Such a progressive increase in volume would be certain to cause disintegration of concrete if it were in sufficient quantity.

Aggregates were also tested by a freezing and thawing test, being placed 5 min. in ice water, then 30 min. in calcium chloride at 0 deg. F., then 5 min. in boiling water, then in ice water for 5 min., and so on for another cycle. A photograph shows the result of this treatment on shale, which broke down from coarse aggregate sizes to sand sizes in 20 cycles.

Other photographs show the effect on concrete of this freezing and thawing method. Specimens made with certain commercial gravels broke up after 25 cycles. One cylinder made with slate aggregate disintegrated after 25 cycles, and the paper says that this shows the difficulty of enumerating deleterious substances. There is no well-defined distinction between slate and shale. The properties of the two vary according to local designation. It is the effect of a substance in concrete and not its local name in which we should be interested.

New Competition in Aggregate Industry

ACCORDING to the *Engineering and Mining Journal*, the Alan Wood Co. iron mine and concentrator located at Dover, N. J. (Scrub Oaks Mine) crushes and grinds a magnetite iron ore which is concentrated on tables and by magnetc separators, leaving a waste product that is converted to a commercial sand by the use of a sand classifier. The overflow from the drag classifier passes to a Dorr thickener to reclaim the water.

Following is a screen analysis of the Scrub Oaks concrete sand:

	Per cent.
—¼-in. + 10-mesh	14
—10 + 30-mesh	45
—30 + 50-mesh	25
—50 + 200-mesh	15
—200-mesh	1
	100

This sand comes within the New Jersey state highway specifications for concrete sand.

During five months the Scrub Oaks mill made and sold 80,000 tons of this crushed-stone sand. This instance strongly emphasizes the tendency for mining industries to, whenever possible, enter the aggregate producing industry. The operation compares with a wet crushed-stone plant, and if a mining company can make and sell a suitable crushed-stone sand, why can't the crushed-stone operators who have been in the aggregate business for years?

Annual Proceedings of A. S. T. M.

COPIES of the report on annual proceedings of the American Society for Testing Materials, Volume 31 (1931), have been issued. It is issued in two parts.

Part I contains the annual reports of the Society committees and the papers and standards appended thereto. The president's annual address and the annual report of the executive committee are also included. Complete reports on metals and non-ferrous metals are given.

Committee reports involve the following nonmetallic materials: Cement, lime, brick, refractories, concrete and concrete aggregates, fire tests of materials, gypsum, and hollow masonry building units.

Papers appended discuss concrete curing; pavement-core drilling practice; analysis of fresh concrete; determination of cement content of set concrete; and elastic properties of concrete.

Other reports of committees included are: road and paving materials, slate, and natural building stones.

In this group there are several extensive subcommittee reports and many proposed specifications.

In order to give as complete a picture as possible of committee activities, the tentative standards which have been prepared by each committee and subsequently adopted as tentative by the Society are included in Part I of *Proceedings*.

Part II contains the technical papers which were given at the annual meeting of the Society in June, 1931.

Several of the papers in the *Proceedings* involve tests of concrete and concrete masonry and structures made therefrom. The freezing and thawing of concrete aggregates; central mixed concrete; temperatures in mass concrete; resistance of fire-clay brick to thermal spalling—these are some of the included subjects.

A Symposium on Weathering Characteristics of Masonry Materials takes up 126 pages of the *Proceedings*.

The Economic Significance of Specifications for Materials is extensively discussed in a symposium.

Geophysical Prospecting

THE Atlas Powder Co., Wilmington, Del., has issued an interesting pamphlet on the use of explosives for locating mineral and oil bearing earth structures. The book describes the use of the seismograph to record the intensity of earth tremors induced by dynamite explosions. Variations in graphs secured from such prospecting methods, due to differences in vibrational conductivity of geological structures, have led to the discovery, in the Gulf coast area of Texas and Louisiana alone, of some 50 or more salt domes, many of which are now producing oil in commercial quantities.

Relation of the United States Bureau of Mines to the Nonmetallic Industries*

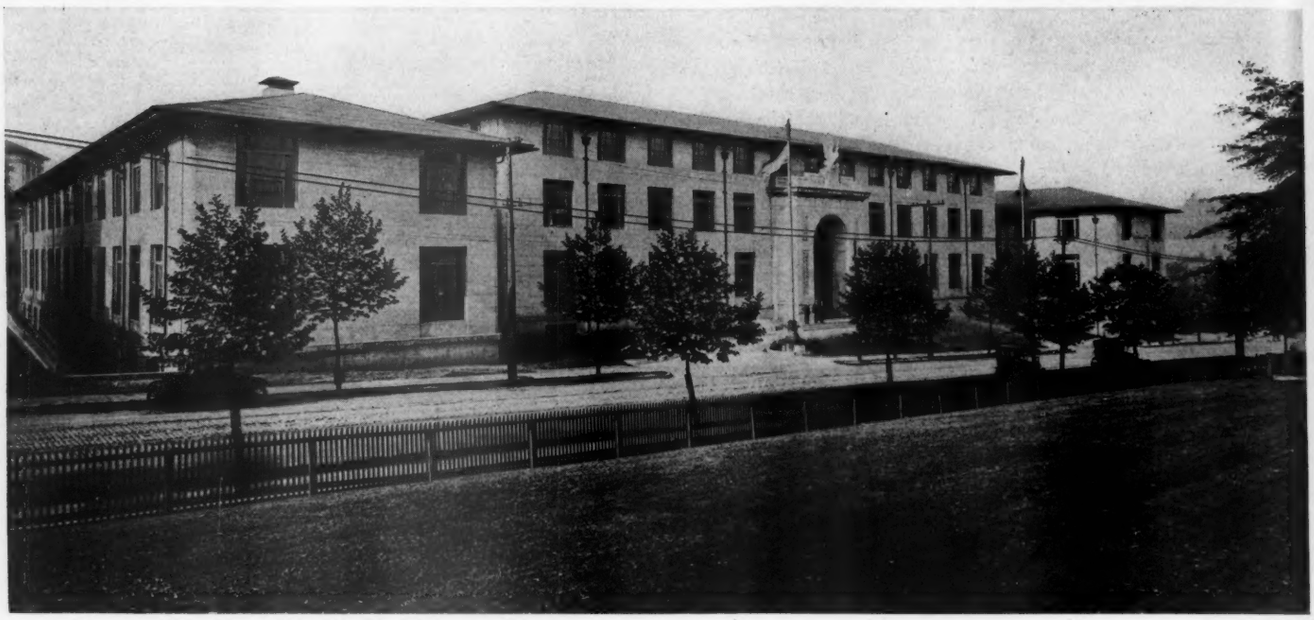


Fig. 1. Pittsburgh Experiment Station, U. S. Bureau of Mines, Pittsburgh, Penn.

THE WORK of the United States Bureau of Mines is divided into four main branches, each of which is composed of various divisions and sections. Bureau engineers engaged in field work are frequently asked how the work of the bureau applies to individual industries. The following is designed to show the work of the various divisions and sections and its application to the nonmetallic industries.

Nonmetallic Section of Mining Division

The plan and organization of the Nonmetallic Section was described in an article by J. R. Thoenen, supervising engineer of the section, in Rock Products for January 17, 1931; therefore only the main objects of its work will be discussed. Because of the scarcity of technical data available on methods and costs of mining and treating nonmetallic minerals, the Bureau of Mines organized a nonmetallic section in its mining division early in the fiscal year, 1931. It is the duty of this section to collect and disseminate technical information as to mining and treatment practices in the nonmetallic field. To carry out such a program on a limited financial budget the operating companies have been requested to appoint staff employes to prepare detailed technical reports on their individual plants. These reports are written in accordance with a prepared outline furnished by bureau engineers. When completed by the author the reports are carefully criticized and edited. In many instances suggestions are made as to additional data. The papers are then mimeographed or multigraphed and issued by the bureau. The authors are paid a nominal fee, inadequate to the time and attention involved, but limited primarily by insufficient funds.

Owing to the various methods of keeping cost data it is difficult to collect cost tabulations on a directly comparable basis. However, the publication of a few papers has greatly stimulated interest in this subject, and as standard cost practices become more universal the value of these papers will be proportionately increased.

During the fiscal year ended June 30, 1931, this section published 2 reports on mining methods and costs in the Illinois fluorspar field, 3 reports on the methods used and costs obtained at cement-plant quarries, 1 on an eastern trap-rock quarry, 2 on sand and gravel dredging operations and screening practice, and 1 on feldspar milling practice, a total of 9 technical reports.

During the first half of the fiscal year 1931-32, 10 additional papers have been published, consisting of 4 reports on cement-plant quarrying operations, 1 on cement-plant crushing and grinding practice, 1 on a commercial crushed limestone quarry, and 4 on sand and gravel operations.

In addition to the above published reports there are on hand awaiting printing 11 reports, 6 of which are on sand and gravel operations, 2 on cement-plant quarries, 1 on a clay pit, 1 on a limestone quarry, and 1 on a gypsum mine.

Because of limited publication funds, it is doubtful if the above 30 reports will all have been published by the end of the present fiscal year.

In addition to the above the section has in various stages of preparation other reports, as follows:

Sand and gravel operations	35
Crushed stone plants	16
Cement-plant quarries	11
Clay pits	6
Talc mines	2
Gypsum mines	2
Salt mines	2
Fluorspar milling	2
Kyanite mine	1
Mica mine	1
Feldspar mine	1
Total	69

So far no attempt has been made to compile the data contained in published reports into comparative or summary papers by bureau engineers. It is felt that there is not as yet sufficient material at hand for this purpose. Conditions under which individual plants operate vary to such an extent that there are little comparable data available as yet.

All of the reports which have been published so far have been republished in the technical press, indicating the popularity of this method of disseminating technical infor-

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mation. In addition, favorable comments have been received from the public, indicating continued interest in this series.

These reports are sent free to a limited mailing list and in reply to requests as long as the printed supply lasts. Interested operators who desire to receive copies as issued may have their names placed on the mailing list by writing to the Bureau of Mines at Washington, D. C. Such requests should specify the NMC mailing list.

Many nonmetallic operators can obtain much interesting data from the metallic mining and milling papers already published by the metallic section of the mining division. Underground quarry operators will be particularly interested in room-and-pillar methods of operation in metal mines. Open-quarry operators can find much of interest in the technical descriptions of open-pit metal mines. All crushed-stone operators, as well as sand and gravel producers, will find a world of technical milling data contained in the milling reports of the metal mine section. These papers cover crushing, screening, grinding, and other treatment processes as used in preparing metallic ores. Much of these data are readily applicable to nonmetallic operations, as, for example, the use of hydraulic classification in sand separation. In all there have been issued 79 papers on mining methods in metal mines and 35 reports on milling methods. A limited number of these papers are available for free distribution. Inquiries should designate the MMC mailing list for metal mining and the Met. 6 list for milling papers.

The nonmetallic section is handicapped by lack of funds in promoting its program as rapidly as desired, but it is hoped that this obstacle will be overcome with a return to normal business conditions. At that time it is planned to make more intensive studies of operating conditions by having bureau engineers in the field personally observe conditions among producers.

It is further planned when the new experiment station authorized by the last Congress is established at College Park, Md., to undertake the solution of such problems in technique as may be desired by the nonmetallic industries. The annual report of the Bureau of Mines describes in more detail the program in connection with this proposed station.

The personnel of the nonmetallic section sincerely appreciate the widespread cooperation of the industry throughout the country. It is hoped that any operator wishing information on operating problems will write to the Chief Engineer, Mining Division, U. S. Bureau of Mines, for in this way only can the division keep in touch with current problems and practices.

Experiment Stations Division

Certain of the investigations of the bureau can best be conducted by the persons working directly in mines, quarries, or plants. Many problems, however, are more adapted to laboratory study, and for such work the Bureau of Mines has established 11 experiment stations. The largest of these stations is the one at Pittsburgh, Penn., shown in Fig. 1. Here are conducted studies on coal mining in all its phases, including mine safety, first-aid, and mine rescue work; fuels chemistry, constitution of coal, carbonization and combustion research; explosive testing and research; toxicity of industrial gases, and metallurgy of iron and steel.

Certain of these investigations directly concern the rock products industries. For example, research on combustion can be applied to the problems of the kiln operator. The bureau's coal analyses, made at the rate of some 10,000 a year, provide a splendid reservoir of information from which the purchasing agent can obtain data regarding possible fuels. Furthermore, highly specialized equipment is available for more pertinent investigations should they be demanded by the industry.

The metallurgical section of the Pittsburgh station has just completed an extensive five-year program on the elimination of nonmetallic inclusions from steel. The resulting higher grade material will be of direct benefit to all steel users.

The explosives section at Pittsburgh has devoted an extraordinary amount of research to the development of safer and more efficient explosives. As part of its accident reduction program the bureau has encouraged the production of explosives which are not too sensitive to sudden impact, friction, or other external influences. To this end it has studied the sensitivity of many types of material in the equipment shown in Fig. 2, and has determined the relation between composition and stability. To be sure that the tested explosives are not only safe but that they will do the work for which they are manufactured, tests are made in the ballistic pendulum shown in Fig. 3. In this test the explosive is discharged in contact with a steel pendulum weighing 16 tons. The swing imparted to this mass is a measure of the strength of the explosive. The type of explosive which will produce maximum or minimum shattering of the material as desired, has also been determined experimentally.

In connection with its Pittsburgh Experiment Station the bureau maintains an experimental coal mine at Bruceton, Penn. All of the research which has been conducted in this country on the use of limestone and shale dust for the prevention of coal-dust explosions has been done here. The rock products industry supplies most of the material for this purpose.

The Nonmetallic Minerals Experiment Station of the Bureau of Mines is located at New Brunswick, N. J. One of the problems at this station has been a study of the retardation of the setting of portland cement. During the last year a very careful study

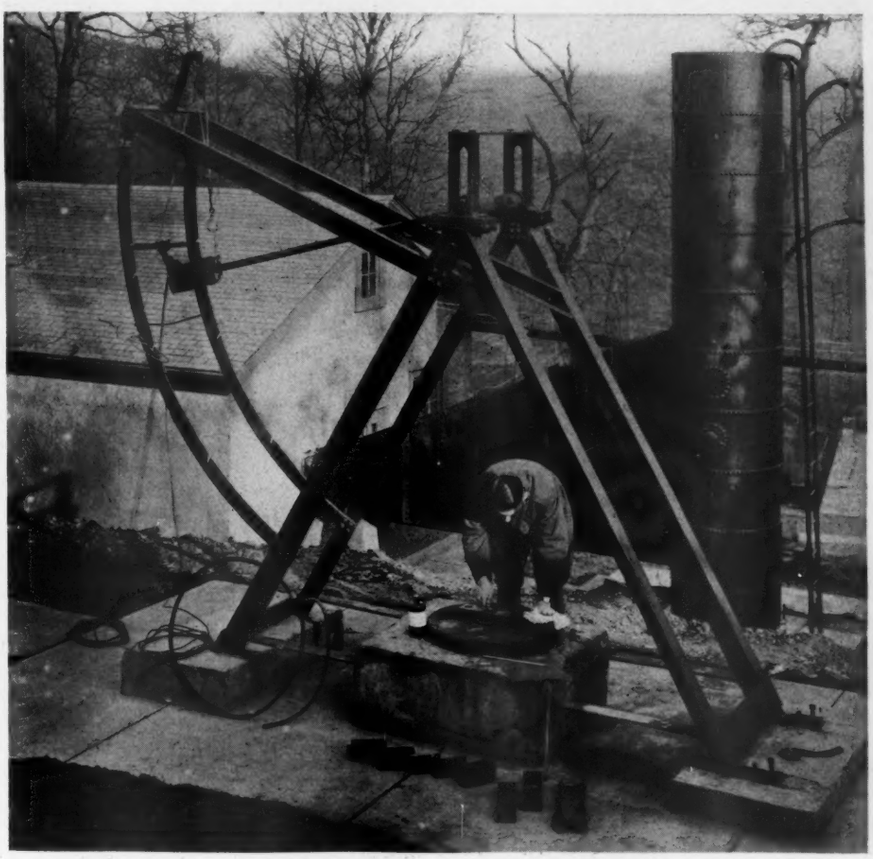


Fig. 2. Apparatus for determining the sensitivity of explosives to friction, U. S. Bureau of Mines, Pittsburgh, Penn.

has been made of the rate of solution of various sized particles of the different forms of calcium sulphate. This work is being followed closely by committee C-11 of the American Society for Testing Materials.

Sieves can be used satisfactorily in sizing particulate matter down to 200-mesh size. The Bureau of Mines at its New Brunswick station has developed an improved elutriator for closely sizing the material below this size. The closeness of its cuts and the completeness of its separation exceed that of any other similar device.

At this station studies have been made on the bulking properties of fine powder. It was found that the volume per unit of weight, namely, the bulkiness, of material through a 200-mesh sieve increased with a decrease in particle size below a certain critical diameter, but was constant above this size. These data are of value to all those industries handling fine powders, such as cement, pigment, and mineral filler.

Nonmetallic research is also conducted at the Northwestern Experiment Station at Seattle, Wash. An investigation has just been completed on the electrical dewatering of cement slurry. Slurry now is being dewatered by filtration in some American plants; clays are being successfully dewatered electrically in Europe. The application of the electrical method to the American cement industry was therefore investigated by the bureau.

At Rolla, Mo., the Bureau of Mines conducts its fundamental studies on ore dressing. Any work on screening or classification, although conducted primarily from the standpoint of metallurgical ores, is equally applicable to the sand and gravel industry.

At its North Central Experiment Station, Minneapolis, Minn., the bureau is studying the explosion-shattering of minerals as a substitute for crushing—a startling new development in the disintegration of ores. During the past few years studies have been made also on the size relationship for crushed or granular products to obtain particle packing of any desired density. This applies to storage problems, making of concrete of maximum density, charging of lime kilns, etc. The flow of gases through such beds has also been studied.

At Salt Lake City, Utah, the Intermountain Experiment Station of the Bureau of Mines is excellently equipped for microscopical research. Many problems which have baffled solution by other methods of study have been satisfactorily solved microscopically.

Fig. 3. Ballistic pendulum for determining the strength of an explosive, U. S. Bureau of Mines, Pittsburgh, Penn.

The bureau also maintains other stations, the past and present work of which has little interest for the readers of Rock Products, but the equipment is available for such use as the demand arises. Alden H. Emery is assistant chief engineer of the experiment stations division.

Division of Mineral Statistics

The principal function of the Mineral Statistics Division consists of preparing annual statistical surveys of all mineral industries, excepting the mineral fuels. For the purpose of conducting the work, the division has two major statistical organizations, one covering metallic materials and another covering nonmetallic minerals. It is the latter office that annually canvasses the producers of crushed stone and sand and gravel and completes the printed statistical analyses on these subjects, in addition to preparing in part or in entirety the statistical pamphlets on 24 other nonmetallic minerals.

The annual reports on crushed stone and sand and gravel, as well as on other nonmetallic minerals, represent essentially the only tangible market facts available regarding supply, demand, and utilization of the specific materials; they are based on reports from individual producers.

The statistical reports are received from operators of sand and gravel pits, for example, some time during the first three months of each year, and are immediately edited and tabulated by the division staff. As soon as available the results are published in the form of a mimeographed press release so that they may be useful to producers at the earliest possible moment. The final printed report, published somewhat later, includes a detailed study of the trends of the industry. The first statistical table of the sand and gravel report for 1929 indicates the general ten-year trend for the industry. The second statistical table shows the extent of the various markets for the different types of materials, with a rough indication of the prices that the producers of such materials might expect to receive. A very comprehensive statistical analysis in the same report indicates the supply of the 12 principal types of sand and gravel materials in each of the 48 states, with the value received by the producers for each type of material over a two-year period. Separate discussions of current developments in various branches of the industry are also included, as well as a statistical report on the import and export movement.

One function of this division is providing data of statistical nature needed for proper evaluation of conditions by other divisions within the bureau in their studies of both technologic and economic problems.

Producers of one group of materials often find these reports useful in showing the degree of activity in the production of their own as well as related materials. Thus, the degree of activity in the cement industry, as depicted in the current monthly cement report, is of interest to the producer of sand and gravel and crushed stone for road and building construction.

The Bureau of Mines recognizes that the usefulness of the data it compiles in market analyses depends largely upon prompt publication. It is making every effort to obtain earlier publication of figures, but this effort will not be successful without the full cooperation of individual producers. The early return of the individual reports will aid the industry by allowing prompt release of data, reduce the expense of working up the reports, and relieve the bureau of the feeling that it is publishing figures that are a year old.

Much light can be thrown on many marketing problems of the mineral industries by

careful study and interpretation of the statistical tabulations published annually by this division. However, in some instances, the form of tabulation used may not present the data in the detail desired by operators.

The bureau welcomes from the industry any suggestions regarding the new forms of statistical tables and analyses that will improve the usefulness of its reports. O. W. Kiessling is chief economist of the Mineral Statistics Division.

Demographical Division

The Demographical Division of the Health and Safety Branch is organized specifically to conduct statistical investigations into matters affecting the health and safety of men employed in the mineral industries. Accident statistics covering nearly all branches of these industries have been collected by this division annually since 1911. The only mineral industries not covered by the division's work thus far are the petroleum and natural gas wells and refining plants, and the iron and steel industry.

The quarrying and mining of stone and the mining of all other nonmetallic minerals are covered by accident reports furnished each year to the Bureau of Mines by operating companies in all states. Every effort is made to obtain a report from all operators, small as well as large, although it is by no means improbable that a few small companies fail to send their reports to the bureau.

The annual reports from producers of nonmetallic minerals are carefully examined by the members of the Demographical Division and are tabulated to show the causes of accidents which have resulted in death or injury to employes. Reports of injuries are intended to cover all cases in which an employe is disabled beyond the day on which the accident occurred. This class of injuries is termed "lost-time" injuries.

Paralleling the figures showing the number and causes of accidents are figures showing the number of men employed during the time each quarry or mine was in operation during the year; also the number of days the plant was in operation, the total number of man-days of labor performed by all employes, whether the plants are operated eight, nine or some other number of hours a day and whether the plant is in operation one, two or three shifts a day.

Additional information, furnished by operators of nonmetallic mines, shows the mining method used to extract the mineral from the ground. Quarrying companies, during the past year or two, have advised the bureau of their operating methods and equipment covering such items as kind of power used for drilling, loading, and hauling; kind of drills used; whether loading is done by hand or power shovel; the type of haulage equipment. These factors are all inseparably related to the accident-hazard of the employes, and their inter-relationship is one of the subjects studied by the Demographical Division.

Since the beginning of the collecton of accident reports for the nonmetallic mineral industries in 1911, a great mass of statistical material has been collected and a large fund of information has been obtained regarding the hazards of quarrying and mining. Statistics revealing the main facts regarding accidents are published annually in bulletins issued by the Bureau of Mines. As far as the funds of the bureau permit, these reports are sent without charge to any operating company desiring to make use of them in their safety studies and accident-prevention campaigns or in studying the subject of compensation-insurance charges. Statistics are published for all states combined and for each state separately, as well as for different kinds of quarries or mines and for different methods of operation.

Needs of operating companies for statistical data that will be helpful in accident-prevention work have been anticipated as far as practicable in the preparation of statistical tables published in the yearly bulletins. Beyond a doubt, however, occasion arises when an individual company, engaged in a particular line of work, may desire statistics in some other form or for a specific branch of the industry or for a different type of quarry or mine which has not been anticipated in the bulletin, or perhaps is not of major interest to many operators. In such cases the bureau will be glad if operating companies will advise it of their specific needs for data concerning accidents. Such information will be furnished, so far as it can be supplied from the reports on file in the bureau without revealing the operations of any single company, since all information furnished to the bureau by operating companies is held to be confidential and not for publication as individual reports. W. W. Adams is chief statistician of the Demographical Division.

Rare Metals and Nonmetals Division

The Rare Metals and Nonmetals Division of the Economics Branch answered last year more than 4000 inquiries concerning various commodities. Inasmuch as many inquiries cover several phases of the same industry, the number of questions answered by letter was over 10,000, of which perhaps two-thirds related to nonmetallics. In addition the division annually furnishes personal advice and assistance to several hundred visitors. Long distance telephone calls even help to make available the informational resources of this division to operators, purchasing agents, and prospective investors. This current service work, replying individually to specific inquiries, draws heavily upon the time of the staff, but it is recognized that the experience of the staff and the data on file belong to the public. Sympathetic and careful consideration is given to every demand for economic guidance with respect to any commodity in the field, whether the inquiry comes from a schoolboy who hopes he has found a diamond or from the head of a powerful company who seeks to formulate his sales effort over the next decade.

A far wider circle is reached by means of the publications. With respect to the major commodities, there are prepared, in cooperation with the Mineral Statistics Division of the bureau, annual reviews, which in addition to presenting the results of the statistical canvass of domestic production include summaries of imports and exports, markets and price data, and general information as to the status of the industry in the United States and foreign countries. These reviews are printed separately as soon as it is possible to get them through the Government Printing Office; later they are combined as chapters of the annual volumes of Mineral Resources of the United States, forming a permanent record of the progress of the respective industries, year by year, as viewed from an American standpoint.

As rapidly as possible the available data are being organized into information circulars, eventually to be expanded into more comprehensive monographs, covering each of the 150 or more relatively important commodities which fall within the field. These circulars are issued in mimeographed form subject to amplification and improvement later. Their primary purpose is to anticipate general inquiries. It is easier for the staff and better for an inquirer if there can be promptly furnished a fairly complete résumé of an entire industry rather than a special letter replying, more or less hastily, to a request with respect to only a single phase of it.

Market research is recognized as one of the principal responsibilities of the department and in preparing the Mineral Resources chapters and circulars of general information it is attempted to assemble available facts and statistics with respect to marketing and also to describe as definitely as possible what are the market demands in the way of grades and specifications. Occasionally it is possible to make at least a guess as to the distribution of sales by consuming industries and considerable time is always devoted to a careful study of existing and potential uses and of intercommodity competition involving the possible substitutes of other materials. In a very few cases a study of geographical distribution and market areas has been undertaken.

With respect to mineral commodities that have a national or international market a valuable service has been developed for putting buyers and sellers in contact. The miner is told who may buy his product and the consumer where he can get a certain mineral raw material. The information circulars usually contain lists of producers and lists of consumers, dealers, importers, and exporters. In addition, an increasing number of lists are sent out daily in response to special requests. In a single month over 145 lists of buyers and about the same number of lists of producers, covering 100 or more different commodities, have been sent out. P. M. Tyler is chief engineer of this division.

Safety Division

The Safety Division of the Health and Safety Branch has a total personnel of 64 men, all of whom are trained in safety work and are available for various kinds of safety activities. These men are fairly well distributed throughout the United States on the 11 mine-rescue railroad cars (Fig. 4), at 11 safety stations, and in 5 field offices.

One of the main activities of the Safety Division is the giving of training in up-to-date methods of first-aid to the injured and

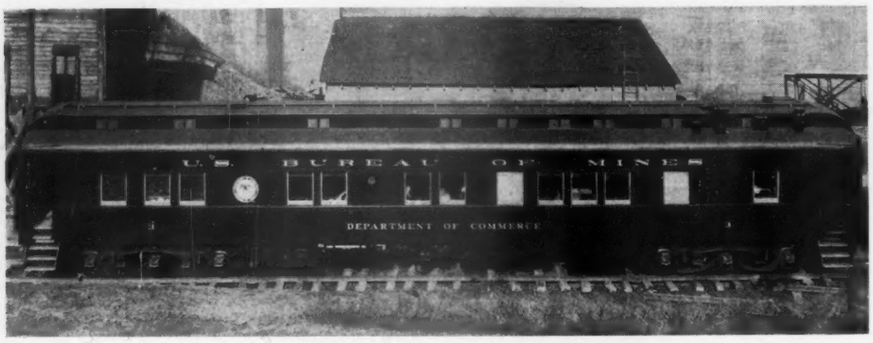


Fig. 4. One of the mine rescue cars of the Bureau of Mines

in mine rescue work (Fig. 5); in the fiscal year ended June 30, 1931, 112,220 full courses in first-aid and mine rescue were given, and 113,358 courses were given in the previous fiscal year. Since its establishment in 1910, the bureau's field forces have given this training to more than 600,000 persons, and as a direct result it is estimated that upwards of 200 lives are saved annually. The indirect results, however, are even more valuable than the direct; it is now known that where the entire personnel of industrial plants are first-aid trained (and last year 250 mining plants wth 57,695 employes were 100% first-aid trained through the Bureau of Mines agencies), numerous benefits, other than saving of pain or even of limbs, are gained by prompt and proper bandaging, artificial respiration, etc. Men who take the full first-aid course become "safety conscious" and are likely to take extra precautions against accidents to themselves or their fellow workers. Some companies report that the first-aid trained workmen are from one-half to as little as one-eighth as likely to be injured as those who have not had the training; other plants say that the year after having the personnel 100% first-aid trained was the first one in which fatalities were avoided, one company having no fatalities one year among the 2500 employes, whereas before the 100% first-aid training had been given the best previous year's record was eight fatalities; other companies report a decided improvement in the relationship of workers to management; and others assert that not only was accident occurrence decreased with material lessening of compensation and medical costs, but efficiency was increased.

Another service of the Safety Division is that of inspecting plants from the viewpoint of safety and then making written reports, giving conclusions and recommendations concerning what was observed, the reports being reviewed carefully in the Washington office of the bureau and transmitted to the plant operator for his *confidential* information. Upwards of 400 written safety reports of various kinds are made annually by members of the Safety Division; this gives the field men an excellent opportunity for wide observation, many of the benefits of which go to the operator in the observations, conclusions and recommendations in these reports. As indicated, the reports are confidential, hence are not published, and are furnished at no cost to the operator.

Every year members of the Safety Division as authors prepare for publication approximately 60 papers or pamphlets giving information on various phases of safety in the mining and allied industries (including the sand and gravel and the crushed stone industries); and special lists have been prepared of names and addresses of persons known to be interested in safety data, to whom the published data is mailed immediately upon its issuance. Persons interested in having their names on these safety lists can secure this service by addressing a letter request to the chief engineer, Safety Division, U. S. Bureau of Mines, Washington, D. C.

As an aid to the forwarding of safety in mining and allied industrial communities, the Safety Division sponsors the establishment and maintenance of chapters of the Holmes Association, and there are now nearly 100 actively functioning chapters having several thousand members in mining and petroleum towns. The Safety Division also sponsors the J. A. Holmes Safety Association, of which 26 other high-class business, technical, scientific, and governmental organizations are the component members. This association specializes in the giving of medals and certificates for heroic deeds in the mining and allied industries and also in the giving of awards of certificates of merit to persons, mines, plants, or companies in the mining and allied industries for meritorious safety achievement. At its meeting in Washington on March 5, 1931, the J. A. Holmes Safety Association gave awards to 9 metal-mining organizations, 8 coal-mining organizations, 6 cement companies, 4 quarries, 3 petroleum organizations, 2 mine-safety organizations, and 6 individuals. These awards are much prized by the recipients and the giving of them aids materially in advancing the cause of safety in the mining and allied industries.

The above are but a few of the activities of the Safety Division. Its services are without cost to the operator and are available at any time to the nonmetallic mining industries. Dan Harrington is chief engineer of the Safety Division.

Health Division

The Health Division of the Health and Safety Branch of the Bureau of Mines is that agency which has to do chiefly with scientific research designed to improve health and safety in the mineral industry. The

Fig. 5. Butte, Mont., first-aid team winning second prize in lifesaving methods

work of this division is carried on in cooperation with the United States Public Health Service, all the medical personnel being detailed to the Bureau of Mines by that service.

In carrying out the work of the Health Division, the laboratory section and the field section work in close cooperation and share a mutual interest in many of the problems undertaken. Whenever it is deemed advisable, laboratory personnel are detailed to the field or field personnel are brought into the laboratory; in this way problems and needs of the industry are dealt with by each section contributing the effort and information it is best fitted to give.

The laboratory section conducts studies on the properties and toxic action of poisonous and deleterious gases, vapors, and dusts encountered in the mineral and allied industries, and devises means for their detection. It develops and recommends preventive measures and emergency treatment so far as possible. This section also tests and develops masks for protection against toxic gases.

The gas laboratory of the section specializes in the analysis of samples of air collected throughout the country by Bureau of Mines field engineers in connection with the health and safety studies.

The stream-pollution laboratory studies the pollution of streams by wastes from the mineral industries with a view to recommending means for preventing or minimizing the untoward effects of these wastes. These studies deal especially with acid mine waters but also consider the fines or slimes from crushing of ores and rock.

The physiological and pathological laboratory studies the untoward effects of impurities in the air, both particulate and gaseous, on the workers who must breathe them. Some dusts are known to be definitely toxic, such as lead, mercury, arsenic; others are usually considered as non-toxic, such as quartz, limestone, coke, and coal. Of the latter group, limestone and coal are least harmful, while the quartz or silica dust is very harmful, producing a fibrosis of the lungs, known as silicosis, which renders the subjects susceptible to tuberculosis. Studies and tests are made to select a dust suitable from the physiological standpoint for rock dusting in mines.

The effects of carbon monoxide, hydrogen sulphide, and other gases produced by ordinary use of explosives, accidental explosions, fires, etc., are studied.

The Field Section makes surveys of the industries to determine the relative effect of the various working conditions upon the health of the workmen. General sanitary surveys include housing. An extended study has been made into the effect of silica dust in which all applicants for work and all workers are examined periodically and each individual is informed of his exact condition.

The information obtained by the Health Division is disseminated to the industry and to the public through the medium of publications supplemented in a large measure by correspondence and personal contact. R. R. Sayers is chief surgeon of the Health Division.

Summary

Bureau work as applied to the nonmetallic industries may be summarized as follows:

1. Technologic studies of mining methods, treatment methods, and operating costs.
2. Laboratory study of technical problems in production, treatment, and utilization.
3. Collection and tabulation of production statistics.
4. Collection and tabulation of statistics relating to the frequency and cause of accidents.
5. Economic studies of production and marketing problems.
6. Studies relating to safe practices and equipment in mineral production.
7. Studies relating to the improvement of the health of men employed in the mining industries.

Specific Heat of Magnesium and Aluminum Oxide

IN A RECENT ISSUE of the *Journal of the American Ceramic Society,* Gorden B. Wilkes of the Department of Industrial Physics, Massachusetts Institute of Technology, describes work done on the oxides of magnesium and aluminum to determine their mean specific heat from room temperature up to 1800 deg. C. and 1700 deg. C. respectively. The pure oxide specimens were heated in a vertical carbon tube furnace with a magnesite tube liner for oxidizing conditions. A special calorimeter was designed and used to prevent the loss of heat by vaporization of the water when the white hot specimens were immersed. The following table gives results of 32 runs on two oxides:

MEAN SPECIFIC HEAT BETWEEN t DEG. C. AND 30 DEG. C.

t deg. C.	Aluminum oxide	Magnesium oxide
100	0.2060	0.2335
300	0.2260	0.2470
500	0.2395	0.2590
700	0.2500	0.2690
900	0.2580	0.2765
1100	0.2645	0.2825
1300	0.2705	0.2875
1500	0.2755	0.2910
1700	0.2800	0.2935
1800		0.2945

Sales of Slate in 1931

THE SLATE SOLD at the quarries in the United States in 1931 was approximately 351,400 short stons, valued at $5,361,000, according to estimates furnished by producers to the United States Bureau of Mines, Department of Commerce. This was a decrease of 24% in quantity and 32% in value from the output reported for 1930—463,610 short tons valued at $7,911,618.

Slate sold for flagging, cross-walks, stepping stones, etc., was estimated at 537,000 sq. ft., valued at $66,000 in 1931, a decrease of 40% in quantity and 34% in value compared with 1930.

The sales of crushed slate for roofing granules and flour in 1931 was estimated at 221,400 short tons, valued at $1,282,000. In comparison with 1930 this represents a decrease of 24% in both quantity and value.

Concrete Ashlar Walls

CONCRETE ASHLAR WALLS is the title of a new booklet describing a recently developed type of concrete masonry.

Illustrated in this 16-page booklet are residences, schools and other recently constructed buildings in which concrete ashlar has been used for both interior and exterior walls. There is a discussion of color treatments and textures that are possible with concrete ashlar as well as a page showing interesting patterns which are suggested for coursed or random ashlar.

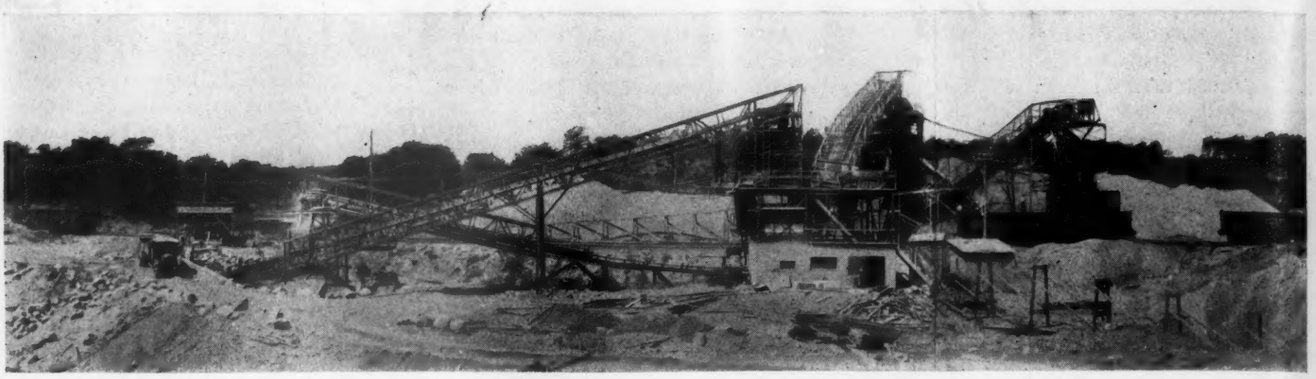
Mineral Producing Industries in Canada, 1930

FINAL FIGURES relating to the mining industry in Canada for 1930, issued by the Dominion Bureau of Statistics at Ottawa, show a total capital investment in operating mines, smelters, refineries, oil and gas wells, clay products plants, cement mills, sand and gravel pits and stone quarries of $887,420,859. Returns were received from 2478 firms. Salaries and wages paid amounted to $113,975,332 and the net sales of mineral products totaled $270,774,581.

The investment in metal mining was $427,439,265; in nonmetal mining, including coal, $328,776,596; and in clay products and other structural materials, $131,204,998.

STATISTICS ON NONMETALLIC MINERAL PRODUCING INDUSTRIES IN CANADA, 1930

	Number of firms	Capital employed	Number of employes	Salaries and wages	Income from sales
Abrasives	10	345,102	45	42,867	80,108
Asbestos	7	35,097,872	2,770	3,474,215	8,390,163
Feldspar	25	106,361	251	113,783	268,469
Gypsum	16	8,796,865	822	781,639	2,818,788
Iron oxides	4	150,704	43	41,238	83,873
Mica	13	441,744	244	63,316	96,004
Quartz	26	764,127	178	143,605	418,127
Salt	8	4,685,549	381	455,539	1,694,631
Talc and soapstone	6	614,384	141	79,472	186,216
Miscellaneous	38	3,608,896	498	527,183	1,181,485
Cement	8	59,210,737	2,317	3,172,198	17,713,067
Lime	44	8,816,879	1,086	1,087,778	4,038,698
Sand and gravel	724	7,550,217	5,601	2,508,037	8,344,913
Stone	285	22,196,388	6,192	5,542,211	13,037,209



General view of the plant

Plant Is Center of Circular Storage

Unusual Stock Piling System at Twin Cities Sand and Gravel Co., Minneapolis, Minn., Plant

OF THE SAND and gravel plants constructed during 1931 one of the most novel is that of the Twin Cities Sand and Gravel Co. near Minneapolis, Minn. In this plant there are a number of deviations from standard practice. Of those features which differ from the average sand and gravel operation the stockpiling system and the use of motor trucks for transporting the material from the pit to the plant are the most conspicuous.

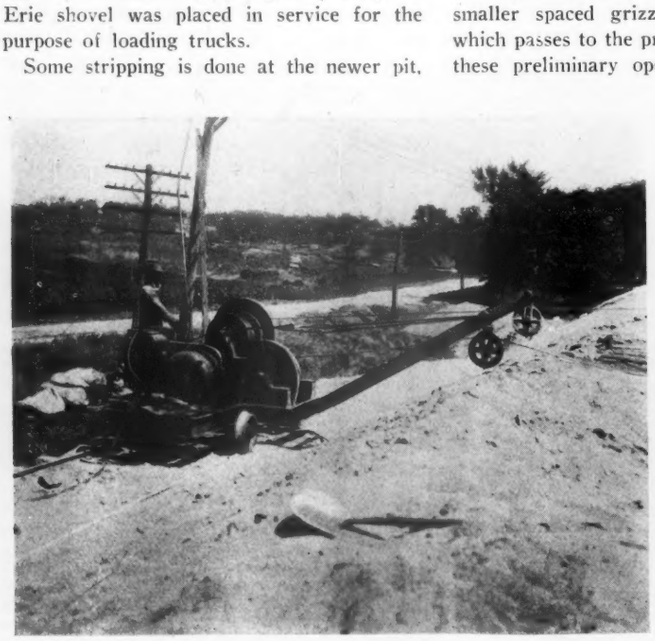
This operation was started in April of this year and first used a drag scraper to transport the material from the pit to the plant, but this method soon exhausted the material near by so that a 1¼-yd. gas-air Bucyrus-Erie shovel was placed in service for the purpose of loading trucks.

Some stripping is done at the newer pit, which is roughly 1000-ft. from the plant. An American Hoist and Derrick Co. 1¼-yd. dragline is used for this purpose. Five International 5-ton trucks are at present in service between the new pit and the plant, this hauling being done by contract.

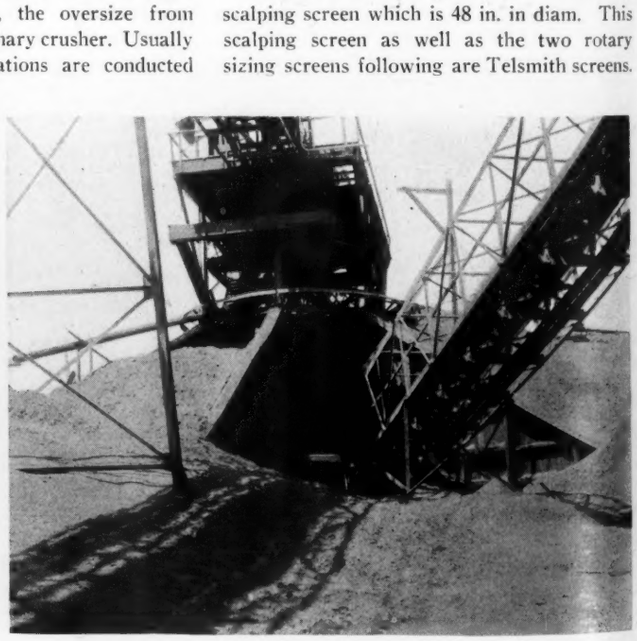
At this point it might be well to note that most of the gravel deposits in the states of Wisconsin and Minnesota are glacial in origin and contain boulders up to the size of a wash tub. As a result of this condition most of the plants pass the pit material over a grizzly with bars spaced on 12- to 16-in. centers. Any oversize is then usually hand sledged to pass the grizzly bars. This first wide-spaced grizzly is often followed by a smaller spaced grizzly, the oversize from which passes to the primary crusher. Usually these preliminary operations are conducted in a natural depression or an artificial one, pit or otherwise, so that full advantage can be taken of gravity. As a result of this procedure no extremely coarse material has to be elevated to the scalping screen.

In this operation, however, the pit material is dumped to a horizontal bar grizzly spaced on 14-in. centers and the oversize is hand sledged through. All of the throughs fall to a hopper from which the material is fed direct by a Telsmith reciprocating feeder to a 30-in. inclined belt. This means then that the belt carries at times rather large boulders which ride the belt up the incline to a second grizzly with bars spaced 4-in. apart.

The fines from this grizzly fall to a rotary scalping screen which is 48 in. in diam. This scalping screen as well as the two rotary sizing screens following are Telsmith screens.



The drag scraper is operated by a hoist mounted on a car which is movable on a track circling the storage pile



The reclaiming belt for loading out to cars carries up from point below the center of the pile

Trucks are used for haulage from the pit to the plant; one end of the pit is shown at the right

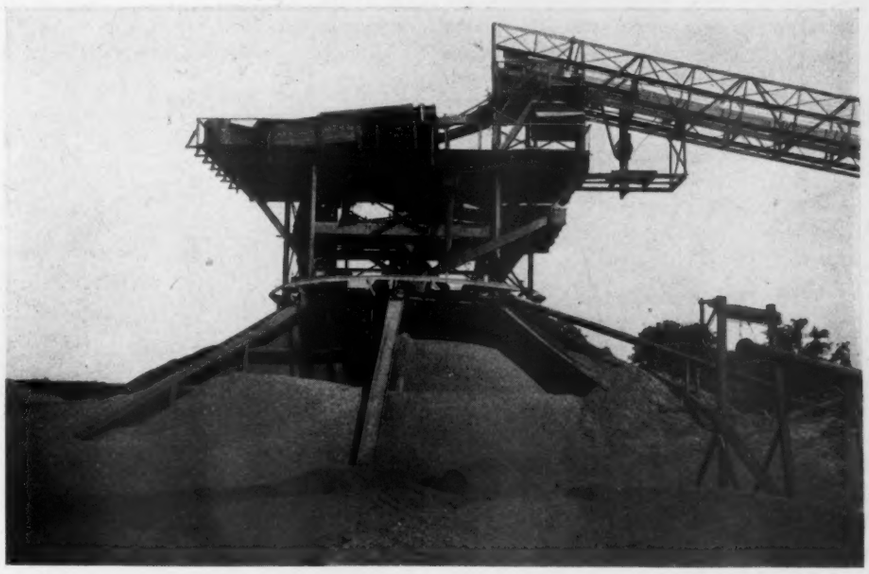
The oversize from the second bar grizzly goes to a No. 13-A Telsmith gyratory crusher. The oversize from the rotary scalping screen goes to a No. 40 Telsmith reduction crusher, while the throughs, consisting of sand and minus 1¼-in. gravel, are carried on a 24-in. belt conveyor to the rotary sizing screens. The material from both crushers is returned on a 20-in. belt to the main 30-in. belt conveyor which feeds the plant. Both crushers deliver a minus 1¼-in. product. The crushers are mounted below the scalping screen.

Stockpiling System

The gravel in this pit is an unusually hard stone. The greater portion apparently had its origin in the trap rock regions to the north of the district. Some granite boulders are also contained in it but not many. The crushing of this hard, tough, trap-rock gravel called for special consideration in the design of the plant and it was stated that the crushing equipment had come up to expectations.

The third novelty of this plant and the most outstanding one as well is the arrangement of the final screening plant with reference to the stockpile and the reclaiming system. In this respect the plant is somewhat similar to the operations of the Hillside Sand and Gravel Co., Milwaukee, Wis., a description of which was published in the March 14, 1931, issue of Rock Products.

As may be seen in the illustrations, two rotary sizing screens are mounted on a platform roughly 50-ft. above the ground level. Two No. 6 and two No. 7 Telsmith sand cones are mounted below the rotary screens to take care of the sand. The sand and



Stock piling arrangements showing partitions and sizing screen above

Two views of the drag scraper which moves the material away from the plant for storage and back again when it is to be reclaimed

The scalping screen is mounted above the crushers

gravel from these screens and cones are chuted to the ground and each size is kept separated by means of a series of retaining walls arranged like the spokes of a wheel. In other words, the seven pockets for holding these materials are arranged in a circle with the screening plant at its center. The circle is really divided into eight equal spaces, seven of which are used for storage and the eighth space is used for the inclined reclaiming belt.

Drag Scraper Used

The structure is of a sufficient height so that the seven compartments will hold 21 cars of aggregate and any production above this is scraped back away from the central structure by a ¾-yd. Sauerman Crescent drag scraper. This is operated by means of a Kern hoist mounted on a self-propelled car which travels on an industrial track circling the edge of the stockpile about 200 ft. from the tower. The operation of the drag scraper is reversible so that the sand or gravel may be scraped back to a point just below the screen structure where it will flow by gravity to the outlet gates and thence to the reclaiming belt.

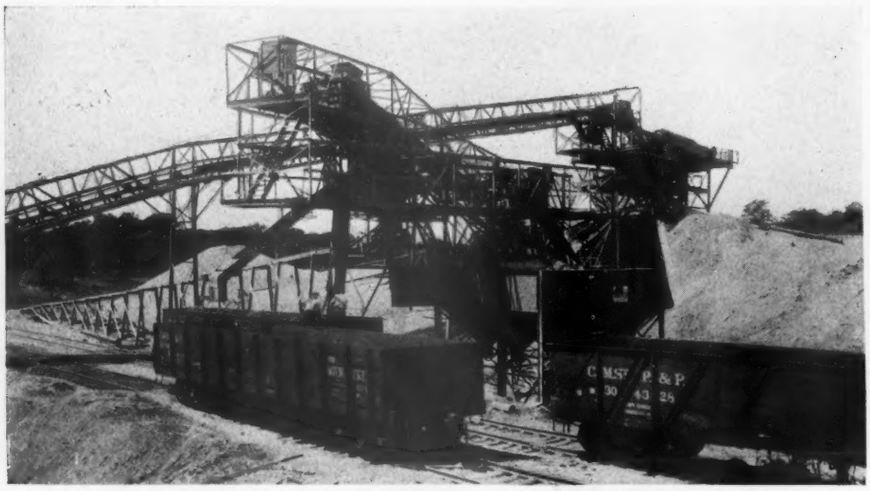
The 24-in. reclaiming belt extends to a point at the center of the circle about 4 ft. below the seven outlet gates which converge at this point to serve the reclaiming belt. By proper setting of the discharge opening of these gates a blended mixture for exacting specifications can be obtained.

The system of stockpiling and reclaiming used at this plant is named after its designer and is called the Kern system of stockpiling, the basic principles of which have been patented.

Storage Permits Drainage

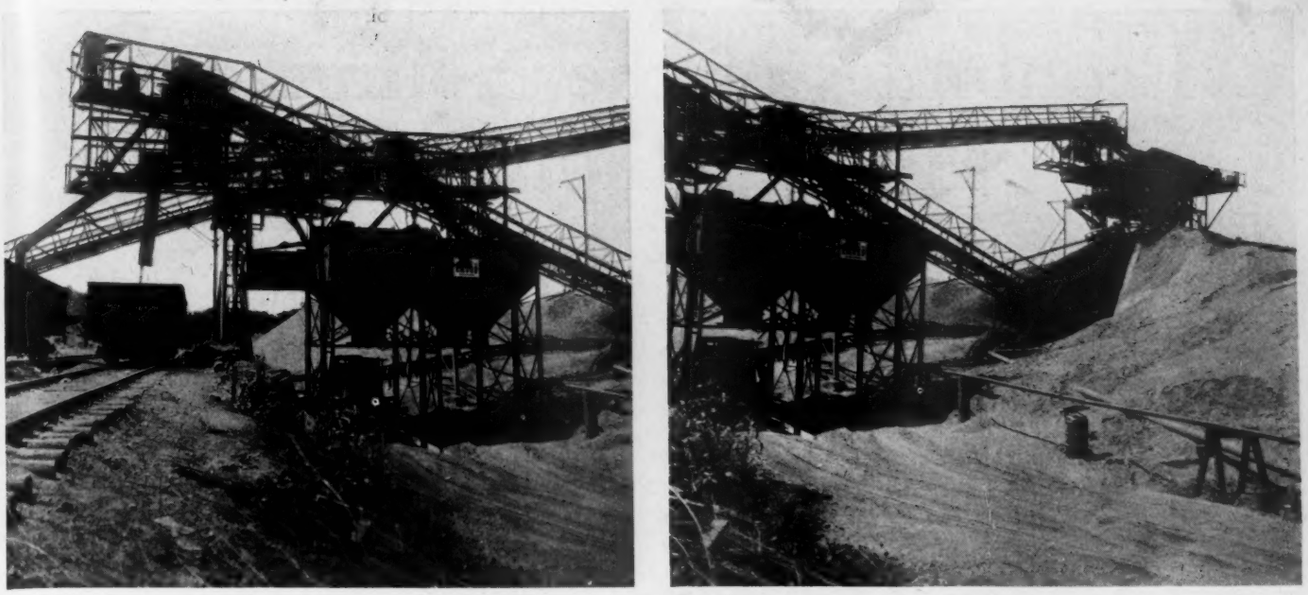
Stockpiling has advantages, as every sand and gravel operator knows, but this system would seem to have added advantages not at first apparent. Approximately three cars of material are available from each of the compartments so that such an amount can be stored without recourse to the scraper system. With this layout it is possible to let the material drain for 24 hours or longer, a condition that is required in some specifications. Thus gravel or sand produced today can be deposited in one of the compartments and material produced the day before can be shipped from a second compartment. By this arrangement it is often possible to reduce any clay balls to a slime and then remove this slime at the loading apron by means of suitable rinsing screens. The arrangement also results in a low moisture content for the stored sands. During the winter months, by heating the inside of the tower, 10 to 15 cars of material could be shipped before calling upon the drag scraper to put more frozen aggregate close to this heated column.

Loading point at center, with sizing screen and stock pile at right



The six bins used for truck loading, with the plant beyond

The plant was built by the Fred T. Kern Co. of Milwaukee, Wis. It is of reinforced concrete and steel construction throughout and no expense was spared to make it an efficient operation. Every bearing in the plant is a Dodge Timken roller bearing, and Texrope drives are used on all motors. All



Cars are loaded on two tracks as shown at left and trucks from bins in foreground

the motors in the plant, unless otherwise specifically stated, were supplied by the Allis-Chalmers Manufacturing Co. The plant has a capacity of 1000 cu. yd. per day.

At present all the conveyor galleries are open, but it is intended to house them in with corrugated iron shortly.

The loading arrangements are such that cars can be loaded on two tracks and the products given a final rinsing with fresh water at this point if desired. Also the reclaimed aggregates can, instead of being chuted into the cars, be bypassed to a short conveyor which delivers the material to six steel bins (four Kern bins and two Brown), from which truck shipments can be made.

Fresh water for washing is supplied by an 8-in. 4-stage Fairbanks-Morse deep well pump which is direct-connected to a 40-hp. induction motor of the same make. This pump delivers 1600 gal. per min. A second 6-in. Allis-Chalmers centrifugal pump reclaims the settled water and returns it to the washing system. This pump delivers 1500 gal. per min. and is driven by a 60-hp. direct-connected motor of the same make. The two pumps are operated alternately.

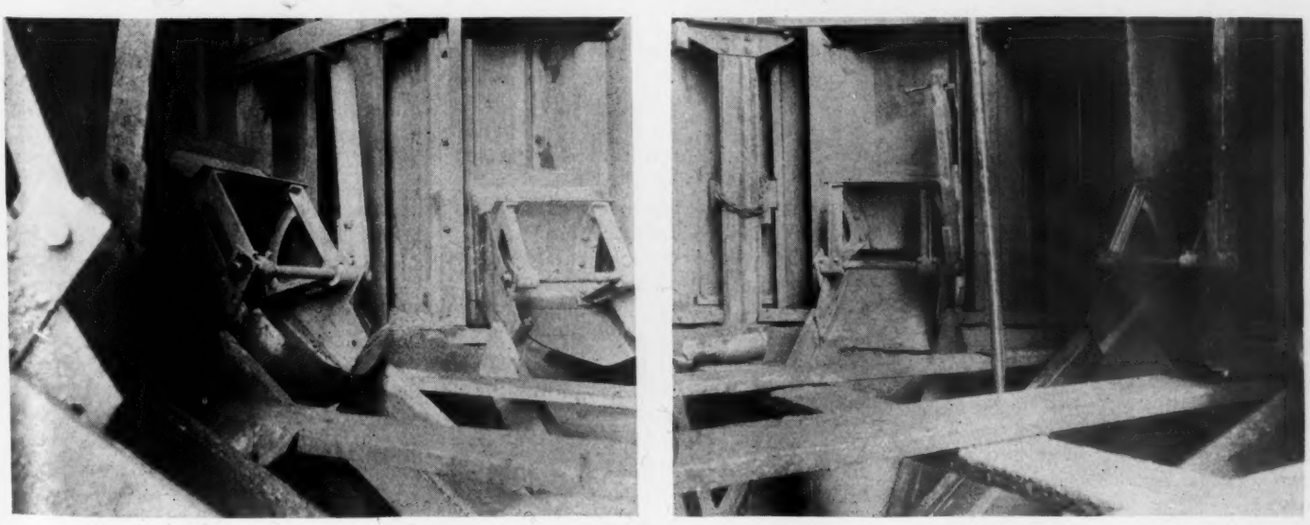
General

The offices of the company are in the Highway building, St. Paul, Minn. The plant is about 9 miles west of Minneapolis and 2½ miles north of Hopkins, Minn., and is served by the Great Northern railroad. Owing to its proximity to St. Louis, Minn., a suburb of Minneapolis, a considerable amount of trucking business is done.

Herman C. Wenzel is president of the company; H. E. Speakes, vice-president and general manager; C. E. Speakes, treasurer; and P. G. Speakes, secretary. Bert Atherton is superintendent. H. E. Speakes has for some years been in the building material supply business in the Twin Cities and is head of the Speakes Co. in St. Paul, which carries on that phase of his operation. The P. G. Speakes Co. will handle the sales in Minneapolis.

MOTOR SCHEDULE

Conveyor from pit, 30-in., 15 deg. slope, 150-ft. c to c	30-hp.
Scalping screen, 48-in. Telsmith-Hercules dry screen	10-hp.
Primary crusher, 13-B Telsmith	50-hp.
Reduction crusher, No. 40 Telsmith	40-hp.
Return belt, 20-in.	10-hp.
Belt conveyor to sizing screens, 24-in.	20-hp.
Sizing screens, 2 of No. 48 Telsmith	20-hp.
Pump for return water, 6-in. Allis-Chalmers	60-hp.
Deep well pump, Fairbanks-Morse	40-hp.
Drag scraper for stockpile, 2 motors, complete	40-hp.
Loading conveyor (reclaiming), 24-in., 140-ft. c. to c	20-hp.
Short conveyor to fill trucking bins	5-hp.
	345-hp.



Two views of the gates at center from which reclaiming and loading belt is fed

Economics of the Nonmetallic Mineral Industries*

Part XII—Water and Motor Truck Transportation

By Raymond B. Ladoo

Manager of the Industrial Commodities Department, United States Gypsum Co.

BEFORE THE ADVENT of railroads all bulk commodities when moved over long distances had to be moved by water. Our earliest transportation of bulk goods was in coastwise sailing vessels plying between ports on the Atlantic coast or between these ports and the West Indies. Later, as our commerce expanded, our ocean-going ships traded in all ports of the world, and inland trade grew along our rivers, always stretching farther and farther to the west. To supplement the rivers, canals were dug, connecting the rivers and lakes. The development of inland country, far from rivers, lakes or possible canals was painfully slow until the railroads came. Then quickly, as the network of steel rails spread, water transportation slackened, died down, and in places became almost extinct, except for ocean and Great Lakes shipping.

Today water transportation is again coming to the front, both for coastwise traffic and along our inland waterways. New canals are being dug, old canals deepened and widened, rivers dredged and straightened. Inland ports are being built on lakes, canals or rivers, and connected with the ocean by channels deep enough to float large, ocean-going ships. Such ports as Stockton, Calif., Lake Charles, La., Beaumont and Houston, Tex., are good examples of such important inland ports. Great Lakes ports, such as Chicago and Cleveland, already receive small ocean-going ships, and in time, if the Great Lakes to the ocean waterway is developed as projected, these cities will become important ports for direct ocean-going foreign trade.

This transportation trend is of great importance to many nonmetallic mineral industries. For many years certain bulk commodities like sand and gravel, crushed stone, brick, etc., have been moved to market by boat or barge, in some parts of the country. Today this tendency is accentuated and other industries are turning to water transportation wherever they can. Perhaps the most noteworthy of these is the portland cement industry. Cement producers with plants on or close to deep water have found they can economically ship cement in bulk by boat to important consuming centers, pump it into storage silos, draw it off and bag it as wanted, and haul it to the job by motor truck. This is now being done at a number of points on the Great Lakes and has been started on the Atlantic Coast and on the Mississippi river.

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Editors' Note

IN THIS ARTICLE the author discusses the many changes which have taken place in the transportation of bulk commodities and the greater use of water transportation combined with truck haulage, which has been made possible by the development of inland waterways and good roads.

Long truck shipments are now common, and this has helped to equalize and lower prices.

The author also points out that buying habits have been changed and hand-to-mouth buying increased.—The Editors.

The gypsum industry has begun to use water transportation in a large way. One company on the Pacific Coast brings its gypsum by boat from its deposit in the Gulf of California to calcining mills at Long Beach, Calif., and Seattle, Wash. Several companies on the Atlantic Coast bring gypsum by boat from Nova Scotia to mills at Portsmouth, N. H., Boston, New York, Philadelphia, Chester, Penn., and other cities. On the Great Lakes a gypsum company with a deposit on Lake Huron, at Alabaster, Mich., has built new calcining mills at Detroit and Chicago, to be supplied with crude rock by boat. Not only is crude gypsum brought to the mill by boat, but, in one case at least, finished products are shipped to dealers' warehouses by water. In New York a gypsum company with a plant on Staten Island operates a fleet of barges in which it carries its products to dealers' warehouses or docks at many points in New York harbor.

The phosphate rock industry has long used water transportation to bring phosphate rock from the Florida deposits to acid phosphate plants at Norfolk, Baltimore, Philadelphia, and in New York harbor. These acid phosphate plants also bring in by water sulphur and pyrites for sulphuric acid making, nitrates from Chile, potash salts from Germany, and so on.

Unquestionably, with the further development of inland waterways, water transportation will become increasingly important in the nonmetallic industries. The combination of water haulage to important consuming centers with motor truck haulage to ultimate destination gives a cheap, quick and effective service that all-rail haulage can hardly equal.

Motor Truck Transportation

Good roads, and automobiles and motor trucks, which make good roads essential, have revolutionized our daily life and buying habits. They have changed the course of whole industries and created new ones. Along with the rest, the nonmetallic mineral industries have been vitally affected. Good roads have not only meant tremendous new markets for crushed stone, sand and gravel, portland cement and so on, but they have changed methods of buying, transporting, handling, storing and selling of these and many other mineral materials.

Before motor trucks were used so extensively, large orders for bulk materials were shipped by rail to the dealer's siding or warehouse and from there hauled to the job by wagon, even when the producing plant was located only a relatively few miles away. Today motor trucks holding 7 to 10 tons and drawing one to three trailers, each holding 7 to 10 tons, may deliver materials from the producing plant direct to the job, perhaps a hundred miles away. Such haulage jobs are common today in many parts of the country. This system has the advantage of speed, no rehandling, no storage of materials by dealers, assurance of fresh stock (important for some products) and deliveries when and where they are wanted. Not only do motor trucks and trailers deliver materials directly from producing plants, but they also deliver for long distances from dealers' warehouses. Today in some parts of the country large city dealers located in strategic centers, with several warehouses and a fleet of trucks, not only serve their cities and immediate suburbs, but reach out for many miles in every direction. They invade neighboring towns 50 miles away and take business from the local dealers. The smaller town and country dealers often cannot buy certain commodities as advantageously as large city dealers, and may have to make a larger margin of gross profit. They may be unable to compete with these long haul motor truck deliveries.

Some sections of the country are always known as low-priced markets, while in other areas higher prices are usually maintained. These differences in price levels are due to many things, such as distance from producing points, size of market, class of population served, business conditions in the district, and so on. One of the chief reasons, however, is the strength and character of the dealers and their ability to "stick together" and not enter on price-cutting orgies. Motor trucks are ironing out these different price levels in many sections. No matter how strong a local dealer organization is, these dealers cannot hold up prices at too high a level if large dealers 50 miles away can deliver in their community by truck. The general tendency, then, is toward lower prices and more uniform prices over wide areas.

Sometimes cases of this type of long-distance competition occur even with rail transportation. Southern California is a very low-priced market for most raw materials. Producers who have national distribution for their products recognize this and usually have a lower scale of prices here than in most other localities. In one case a nationally known product sold for $80 in Los Angeles and $120 to $150 in the East and Middle West. A buyer in Texas, by chance, had been in California and knew of this situation. Instead of paying the local price of $120 he bought in Los Angeles at $80 and paid the freight to his Texas home, saving $20 or $25. This deal "broke" the local price.

Motor trucks and automobiles have not only changed methods of distribution but they have changed retail buying habits. Farmers and residents of small towns used to buy from mail order houses or from their small local dealers. Today they jump into their car or truck and drive 25 to 50 miles or more to the nearest large city. Perhaps they haul in a load of farm produce or take their family in for a holiday. While in the city they buy what they need from large city dealers. The large mail order houses such as Sears, Roebuck and Co. and Montgomery Ward have felt keenly this change in buying habits and have answered it by establishing their own chains of retail stores all over the country.

Good roads are rapidly changing distribution of population. Homes were formerly built close to centers of towns or near street car lines. Today suburban communities are rapidly rising far from populous centers and homes are built long distances from railroads or street car lines. Automobiles and motor buses provide the transportation. This means that either building materials are trucked long distances or new dealers appear. New small manufacturing industries spring up in unexpected places to meet the changing needs of the communities.

Influence of Transportation on Marketing

All these changes influence not only production and transportation of materials but also marketing conditions. Frequent analyses of markets are necessary.

Our transportation systems in most districts are so good today that they have influenced buying habits in another way. "Hand-to-mouth" buying is unquestionably due in part to the general feeling that rush orders can be filled promptly and delivered quickly. No longer does the industrial user or the dealer need to carry large stocks of raw materials. Most producers have ample or excess capacity, and rail, truck or water transportation is so efficient and dependable that the consumer can nearly always be sure of prompt service. Of course this hand-to-mouth buying is sometimes overdone; dealers or industries try to steer too close to the line and occasionally get caught. Strikes, railroad accidents, floods, labor shortages, unexpected peak demands, etc., sometimes prevent the accustomed speed in making deliveries. If a plant or job is absolutely dependent upon regular deliveries of a raw material, simple common sense dictates that at least a small reserve supply be maintained, no matter how dependable the source of supply may be. Portland cement plants, blast furnaces and similar industries suffer large losses if they are compelled to close down even for half a day. No delays can be permitted in the building of a large city office building, especially when it is being built under a time-penalty contract.

It is for this reason that large consumers usually prefer to deal only with large, strong producers, even if they occasionally have to pay slightly higher prices. They know that large producers with their resources, ability, and many deposits and plants can and will supply them in a crisis. The small single plant producer has no alternative if he has to suspend or delay shipments, but the large producer can always ship from another plant or by another route and somehow keep his customer supplied.

(To be continued)

Fuller's Earth

PRODUCTION of Fuller's earth during 1930 shows an increase in tonnage with a slight falling off of prices, although the gross value for 1930 exceeds that of any of the past ten years, according to statistics compiled by the United States Department of Commerce.

Fuller's earth includes many natural substances, clays, etc., that have the property of clarifying and bleaching oils, as well as for filling fabrics. The production for the past six years is given in the following table:

Year	Operators reporting	Short tons	Value at Mines — Total	Value at Mines — Average
1925	14	206,574	$2,923,965	$14.15
1926	14	234,152	3,356,482	14.33
1927	16	264,478	3,767,038	14.20
1928	17	287,012	3,895,991	13.57
1929	17	315,983	4,309,723	13.64
1930	15	335,644	4,326,705	12.89

Properties of Silica Brick

NEW DEVELOPMENTS in the field of silica refractories include greatly improved refractories and a high development of the desirable qualities in silica refractories manufactured from Sharon conglomerates. The nature of silica refractories in general is discussed by L. L. Frederick, Jr., in a recent issue of the *Journal of the American Ceramic Society*. A résumé of materials utilized in the manufacture of silica brick is also given.

Comparative tests between Pennsylvania silica brick and brick from the Sharon (Pottsville) conglomerate were made. In every instance where comparative tests were possible the two bricks were found to be equal within certain limits. The authors are convinced that there is a future for brick manufactured from the Sharon conglomerate and that it is fully equal to the average silica brick. It is said that the conglomerate is satisfactory for gas producer sets, lime kilns, etc.

Digging Gypsite

THE Arizona Gypsum Plaster Co., Cochise county, Ariz., is using a Buckeye trench digger for digging gypsite and loading it to trucks, according to an article in a recent issue of *Engineering and Mining Journal*.

The author, J. B. Huttl, states that the deposit is about 4 ft. deep. The digger is mounted on a truck that rides a movable industrial track that parallels the length of the deposit. The digger discharges the material to a truck. The required time to excavate and load 10 tons is about 15 min.

Production and Value of Barite in 1930

THE following statistics on the tonnage and value of crude barite sold by producers in the United States for the years indicated are from reports of the United States Bureau of Mines:

Year	Short tons	Value
1926	237,875	$1,773,293
1927	254,265	1,670,878
1928	269,544	1,754,924
1929	275,285	1,851,989
1930	234,932	1,538,171

Potash*

THE PRODUCTION and amount and value of potash sold in the United States in the years 1926-30 are as follows:

Year	Number plants reporting	Short tons produced	Short tons sold	Value of material sold
1926	7	46,324	51,369	$1,083,064
1927	9	76,819	94,722	2,448,146
1928	9	104,129	105,208	3,029,422
1929	5	107,820	101,370	2,988,448
1930	..	105,810	98,280	2,986,157

*From United States Bureau of Mines reports.

A Limestone Tester for Field Use

By Paul Emerson
Associate Professor of Soils, Iowa State College, Ames, Iowa

LIMESTONE DEPOSITS usually occur in layers of different chemical composition. The public demands a product of uniform standard. The producer is faced with the difficulty of complying with the requirement. The purity and character of the product may therefore be one of the main questions about the plant. If the producer wishes to consistently supply the consumer with a high grade product he must exercise some method of control. Usually he takes frequent samples and has them analyzed. The larger producers generally employ a chemist to take care of this control measure. The smaller producers cannot afford this expense, consequently must either have a commercial chemist analyze a few samples at a time or must take a chance with a variable product. In either case, the results are rather expensive and, when samples are shipped a distance, there is more or less delay.

The analysis of the sample is made in two ways. First, the chemist may determine the amounts of the different elements, for instance, calcium, magnesium, etc., that are present. Such analyses are more or less involved and time consuming. Second, he may determine only the amount of carbonates present, the amount of carbonates in practically all cases being an infallible indication of the purity of the material. The latter method is used in the majority of cases, particularly in those plants where the product is destined for the kiln or the farm.

The Lime Analysis

When the chemist analyzes a limestone sample for its carbonate content he takes advantage of the fact that an acid will react with the limestone according to the following reaction:

$CaCO_3$	+	2HCl	=	$CaCl_2$	+	CO_2	+	H_2O
Calcium carbonate		Hydrochloric acid		Calcium chloride		Carbon dioxide		Water

The combination taking place in the following proportion:

100	+	72.92	=	110.92	+	44	+	18
$CaCO_3$		2HCl		$CaCl_2$		CO_2		H_2O

This means that 100 parts (by weight) of pure lime (as calcium carbonate) will combine with 72.92 parts of hydrochloric acid to form: 110.92 parts of calcium chloride (a neutral salt); 44 parts of carbon dioxide (a gas), and 18 parts of water.

But one cannot conveniently use a large amount of the material for analysis. If a small amount is used it must be weighed very accurately. The difficulty of securing such accuracy under field conditions has been a decidedly limiting factor in the development of an accurate field method. One cannot easily transport a delicate balance capable of weighing to an accuracy of 1/100 gram. The method to be described later has overcome this difficulty.

Assuming that the sample has been accurately weighed, the analyst may complete the determination in any one of a number of ways with equal accuracy. First, he may place the sample in a closed container, mix it with an excess of acid and collect the evolved gas. By measuring the volume of the gas and applying certain factors, for variations in temperature, pressure, etc., the amount of carbon dioxide, hence the purity of the sample, may be calculated. The apparatus described by McHargue of the Kentucky Agricultural Experiment Station and by Hopkins of the Illinois station is of this type. The appliance has not been generally adopted because of its extreme size and the complications involved in calculating the results.

Second, the analyst may place the accurately weighed sample in a modified hydrometer containing an excess of acid. The apparatus may be weighed or may be floated to a certain mark in water. Then the acid and the limestone are allowed to mix. Of course the carbon dioxide gas is formed and escapes. This causes a loss in weight and the purity of the material may be calculated accordingly. If it is floated in water the apparatus may be so graduated as to indicate the purity directly. Barker of the New York Agricultural Experiment Station has designed an apparatus of this type that gives excellent results. The chief drawbacks are the necessity of an accurate balance, the high initial cost, the difficulty of cleaning, and (as it is entirely constructed of glass) its fragile nature.

Third, the analyst may place the accurately weighed sample in a definite volume of acid but an acid whose strength has been accurately adjusted. After the reaction between the acid and the limestone has ceased, the unusued strength of the remaining acid may be accurately measured by simple titration methods. Naturally the purity may be easily determined. The author has taken advantage of this method and has so adjusted its possibilities to certain forms of apparatus as to overcome all objections of previous tests and also meet all the requirements of the field. The apparatus is compact (weighing less than 8 lb.) and is easily moved. The method is fool-proof, accurate and rapid, and does not require a chemist to operate. In fact, the operation and interpretation of results may be made by anyone capable of reading and following simple instructions. Demonstration of the apparatus before a number of individuals has proven its practicability.

Editor's Note

THIS article describes a simple method of testing limestones which should be very valuable and useful to limestone producers, county agents and others interested in a quick and accurate determination of the percentage of lime in limestones. It is also applicable to the determination of the lime content of soils and other materials.

Method of Analysis

The method takes advantage of the fact that a definite volume of acid, of a definite strength, will completely react with a definite amount of lime. For instance, one gram of the sample (if 100% pure calcium carbonate) will exactly neutralize 25 cc. of an 8/10 normal (0.8/N) hydrochloric acid. If the sample is not pure then the amount of acid left over may be titrated provided the proper indicator is used. As each cubic centimeter of the acid neutralized is equivalent to 100/25 or 4% of the total purity, the amount of alkali used to complete the reaction will of course indicate the exact purity of the sample. The container, therefore, may be so adjusted as to complete the titration in it and so graduated as to measure the amounts of alkali used. If the strength of the alkali is adjusted in fractions of the 0.8/N acid, then the graduations will indicate directly the percentage purity of the sample being tested. It has been found that an 0.4/N alkali gives the best results.

Apparatus Used

The apparatus, illustrated in the accompanying photograph, consists of a number of parts, as follows:

(1) A 25 × 250 mm. glass tube, graduated in such a manner that, by the use of standard acids and alkalies, the percentage

of lime (as pure calcium carbonate) in the sample may be read directly.

(2) A modified hydrometer equipped with a removable metal pan on the tip, and so constructed as to float free in the graduated tube. This hydrometer will enable one to weigh one gram of the limestone sample with a marked degree of accuracy. This device takes the place of the delicate balances which have always been necessary in other testing appliances, yet have been so cumbersome to transport.

The balance of the equipment consists of the necessary solutions (water, acid and alkali), an alcohol burner for heating the sample to boiling, mortar and pestle for grinding the material to a proper degree of fineness, graduated cylinder, holder, carrying case, etc.

The Determination

The sample is first ground in the mortar until the particles are of the consistency of very fine sand. Fine grinding is essential in order to secure a close contact of the acid with the particles and a rapid neutralization effect. The tube is filled with water, the hydrometer inserted and the whole placed in an upright position so that the hydrometer will float free. As the temperature of the water will vary, thus causing the hydrometer to float at different heights, it is necessary to determine the correct position of the mark in relation to the surface of the liquid by testing the hydrometer with a one gram weight before attempting to weigh the sample. Once the correct height is observed, it is a simple matter to remove the weight and replace it with the sample. Nor does one have to be careful that none of the ground material drops into the water. It is only very slightly soluble, hence will settle to the bottom without disturbing the weighing process.

The hydrometer is then removed, the tube emptied, rinsed with distilled water and the weighed sample dropped in. Next 25 cc. of the testing acid (which contains an indicator having a brilliant yellow color) is exactly measured out in the graduate and added to the sample. As there is liable to be considerable effervescing, it is advisable to add the acid slowly at first. When the entire amount has been added the tube is then placed over an alcohol flame and allowed to boil for five minutes or until the evolution of gas from the particles has ceased. This boiling merely hastens the completion of the reaction. The same results may be secured by allowing the tube to stand at room temperature, with frequent shakings, for about four hours. After boiling, the solution is allowed to cool to approximately room temperature and sufficient distilled water added to bring the volume to the lowest mark on the tube. This mark indicates a percentage purity of 100.

The determination is completed by adding the alkali, drop by drop, until the yellow color of the solution turns a deep purple. As the strength of the alkali is so adjusted as to correspond with the graduations of the tube it may be readily seen that the final height of the solution in the tube (at the neutral point) is actually the percentage purity and is thus read directly. There are no calculations or adjustments of results. The time required to complete the entire determination is approximately 10 minutes.

Applications

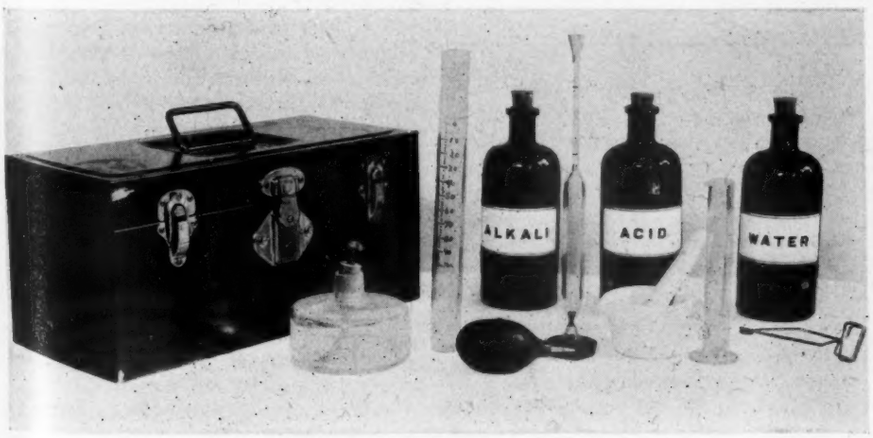
There appears to be a wide use for the above method. In the larger plants, even those employing a chemist and specializing in calcitic or magnesic products, the method will aid the pit foreman in the selection of his raw material. There is no question regarding its application in the case of smaller plants where guess work is the general order and the product extremely variable. Not only may the rock deposits be tested but the product of the plant may also be checked before shipment.

The manufacturer of portable grinding equipment has a direct interest in the method. In many cases the salesman must demonstrate to the prospective customer that he has at hand material having local or commercial possibilities. If he can do this quickly then he will be in a position to clinch his sales arguments. The usual method of assuming that the deposit is good or waiting for a report on the samples from some authoritative source does not aid sales. Furthermore, the method enables the local grinder of limestone to keep an absolute check on his product.

Possibly the most extensive use of the method will be by county agents. Not only may they check their lime purchases and analyze the limestone samples brought in by farmers, but they may also determine the amount of carbonates in a calcareous or an alkaline soil. The procedure in the latter case is identical but the weight of the sample varies. In the case of low lime soil the sample may be from four to eight grams; in the case of high lime soils it is from two to four grams. The reading of the tube therefore must be divided by the weight of the sample in order to arrive at the correct percentage composition.

Cost

The indications are that the cost of the necessary acids, alkalies and alcohol for making a single analysis in the field will be approximately 5 c. The hydrometer and the graduated tube, which must be made according to exact specifications, are the most costly portions of the equipment. With care they should serve for an unlimited number of determinations. The entire equipment, packed in a neat carrying case, should not exceed $10. The patentable features of this apparatus are being investigated and steps are being taken to make it available to the public.



Apparatus used in making field tests

Unusually Long Slurry Ring in a Cement Kiln

THE FORMATION of an unusually long and thick slurry ring 49 ft. long in a 207 ft. cement kiln and the circumstances in connection with its formation are described by O. Frey in a recent issue of *Cement and Cement Manufacture*, London, England.

The ring was believed to have been caused by the high sulphur content of the coal, the ash of which carried 7% $CaSO_4$, and the high burning temperature of 1525 deg. C. called for by the high silicate modulus of the raw material. The raw material had an average composition of 14% SiO_2, 43.7% CaO and 4% R_2O_3. The slurry had a fineness of 92-93% minus 180 mesh and contained 36% water.

It is thought that the $CaSO_4$ of the coal ash fell on the material in the kiln as a fine liquid spray, making it sticky and over a period of time causing the ring to be formed. Analyses of samples taken from different parts of the ring showed that the $CaSO_4$ content increased from 7½% at the end toward the flame to 49% at the end away from the flame. A ring formed in the clinkering zone and due to the coal ash contained no sulphate.

Another contributing factor may have been the lengthening and pointing of the flame and the excess of air as the kiln was worked under forced draft.

Investigations at the Bureau of Standards Dealing with Masonry Construction, Cement, Lime, Gypsum and Stone*

Abstract

THIS summary covers the work of the Bureau during 1931.

In the field of cement many investigations were carried out on the strength, volume change and temperature rise of high-early-strength and masonry cements; the reaction with water of calcium silicates and aluminates; durability tests by titration in sugar solutions; decomposition of tricalcium silicate at temperatures of 1000 to 1300 deg. C.; the possibility of burning clinker at low temperatures by using boric acid as a flux; and the curing of cement products in steam.

Other investigations include the phsical properties of cast stone, water proofing agents for concrete, the effect of clay as an admixture, and the properties of building units made of cinder concrete. Volume changes and water penetration in brick masonry were also studied and tests made on reinforced brickwork, brick-encased steel columns and combination hollow tile and concrete floor slabs.

In the field of gypsum, determinations were made of the volume changes of gypsum fibre concrete and the heat of solution of calcium sulphate and its hydrates. A device was also assembled by which the distribution of fine particle sizes of lime may be determined.

Slate was investigated and a quality specification devised for roofing slate. The results of freezing and thawing tests on sand-lime brick are also noted.

Further investigations are under way on the frost resistance of various types of stone, stone preservatives and the abrasive hardness of stones.—The Editors.

AN INVESTIGATION of the properties of the new class of cements, generally known as high early strength portland cements, was begun in November, 1929. Concrete cylinders, 6x12 in., are made in a 1:2:4 mix with water-cement ratios of 6.5, 7.5 and 8.5 gal. per sack of cement. Specimens are made for each of four different initial storage conditions (first 24 hours after mixing) and four subsequent curing conditions. The initial storages are in air at 70 deg., 90 deg. and 110 deg. F., and in a thermally insulated box in a 70 deg. room. The curing storages are in air at 70 deg., damp room at 70 deg., outdoors, and alternate freezing and thawing. Strengths are determined at 1, 3, 7, 28 days, 1 year and at a later age for the damp-cured specimens; at 7, 28 days, 1 year and a later age for the air-cured specimens; at 1 year for the outside specimens, and at 300 cycles for the freezing and thawing specimens. The temperature changes during the first 24 hours were determined by means of thermocouples inserted in the cylinders. Volume changes are determined by means of micrometer measurements made upon glass squares in the ends of the specimens, the distances between which are read at various times.

The specimens for 12 different cements have been made. The one-year tests have been completed on four cements.

The results thus far obtained show the following:

1. With the exception of one cement which fell considerably below all the others, the one-day strength for the 70 deg. F. initial storage varies from 900 to 1470 lb./in.^{2} for the lowest water-cement ratio, and between 390 and 590 lb./in.^{2} for the highest water-cement ratio.

2. For any particular cement and water-cement ratio, the one-day strengths for the different initial storages generally increase in the following order: 70 deg., insulated, 90 deg., and 110 deg. This order is, however, not maintained in the later ages. The one-year results so far obtained show that the curing conditions have a much greater effect than the initial temperatures.

3. The temperature rise during the first 24 hours is highest for the insulated storage. Generally the cylinders giving the highest temperature rise have the highest one-day strengths.

4. The cylinders stored in the air of the laboratory shrink; those stored in the damp room expand. The length measurements do not show any definite influence of the various water-cement ratios or initial storage conditions. The freezing and thawing specimens, which are read at the end of a year, and at 300 cycles, show greater expansion than the corresponding specimens cured damp at 70 deg.

Masonry Cements

The study of masonry cements and mortars has been continued during the past year. Certain hitherto unmeasured properties, such as plasticity, water-retaining capacity and volume change, are being studied, and further workability, an essential property in masonry cementing materials, is being given particular attention. The compressive strength of 2-in. mortar cubes is also being determined.

Plasticity is measured in accordance with the principle employed in the McMichael viscosimeter—that is, shearing of the material by a fixed body in a rotated cup. The water-retaining capacity is measured by exposing one side of a thin slab of the mortar to a slight vacuum for various periods of time. This simulates the water-withdrawing action or "suction" of a brick.

Volume change is measured from the time the mortar is mixed, through long storage periods when stored both at 60-70% relative humidity and inundated. Six specimens of the mortar are cast in a vertical manifold water-tight mold containing six 1 by 1 by 8 in. compartments with glass plates cast in each end of the specimen. Immediately after filling, the mold is placed under six dial strain gages—one gage for each specimen—by which the shrinkage is measured through the setting period. When the specimens have hardened sufficiently they are removed from the mold and placed in damp closet storage for one week after which they are subjected to the two storage conditions already described. Measurements are made daily for the first week after removing from the molds, weekly for one month, and monthly from that time on. The cubes are made in three consistencies. They are stored one week curing in the damp closet, one week inundated, and finally one-half are placed in air at 60-70% relative humidity, the other half being kept under water. Cubes are broken at 7 and 28 days, 3 months, and 1 year from the date of making.

The study of the interesting property of volume-yield has been added to the investigation. This includes density determinations of the masonry cements, both dry and in the neat mix. Certain devices for the measurement of the above-mentioned properties have been developed during the investigation and they are now being used on some 40 or more masonry cements now on the market.

Reaction of Water on the Calcium Silicates

Although compounds of calcium and silica are among the major constituents of portland cement and are largely responsible for its hydraulic properties, little is known concerning the reaction of these compounds with water. It was the purpose of this work,

*Publication approved by the Director of the Bureau of Standards of the U. S. Department of Commerce.

therefore, to secure quantitative data which will indicate the role of the calcium silicates in the hardening of cement.

Accordingly, a study has been made of the combined effects of hydrolysis and hydration of $3CaO \cdot SiO_2$, beta $2CaO \cdot SiO_2$ (constituent of portland cement), and also $CaO \cdot SiO_2$. When shaken with water the two former compounds form metastable solutions while $CaO \cdot SiO_2$ does not, and this is believed to account in part for the fact that $3CaO \cdot SiO_2$ and $2CaO \cdot SiO_2$ are hydraulic and that $CaO \cdot SiO_2$ is not. Metastable solutions obtained at progressive stages of the hydrolysis of $3CaO \cdot SiO_2$ and beta $2CaO \cdot SiO_2$ show a steady decrease in silica content with increase in lime content and a corresponding decrease in metastability. On standing, the metastable solutions decompose with the formation of colloidal or microcrystalline precipitates. Petrographic examination of these precipitates has failed to reveal any crystal form or to identify the phases present. Analyses of the solutions, in the clear metastable state and after attaining equilibrium, show that the precipitates contain lime and silica in molecular ratios varying from $1.1CaO:1SiO_2$ to $1.8CaO:1SiO_2$, depending upon the concentrations of the lime in the solutions with which they are in contact. If precipitation takes place in almost saturated limewater it is believed that the precipitate will approach the ratio, $2CaO:1SiO_2$, and this assumption is being tested. Tricalcium silicate hydrolyzes very rapidly, giving an almost saturated lime solution after four hours shaking, hence the precipitates derived from it have a higher lime content than those from beta $2CaO \cdot SiO_2$, which liberated lime and silica to the solution more slowly. Also beta $2CaO \cdot SiO_2$ almost completely loses its metastable solubility in solutions containing more than 0.5 gram per liter, whereas $3CaO \cdot SiO_2$ retains its metastability in nearly saturated limewater.

Monocalcium silicate when shaken with water gives only stable solutions and reaches its maximum solubility at a concentration of about 0.111 gram CaO and 0.106 gram SO_2 per liter. A quantity of $CaO \cdot SiO_2$ solution was made up and mixed with saturated limewater in various proportions. The precipitates so obtained were found to contain lime and silica in molecular ratios varying from $1.0CaO:1SiO_2$ to $1.7CaO:1SiO_2$ and contained somewhat less lime than precipitates derived from $3CaO \cdot SiO_2$

pH measurements upon calcium silicate solutions indicate that they consist of monocalcium silicate in the presence of excess lime.

The "equilibrium" solubility of SiO_2 has been further investigated by boiling highly purified silica gel with dilute limewater for long periods of time, followed by cooling to the desired temperatures. Such experiments show the maximum solubility of SiO_2 at 30 deg. C. is about 0.25 gram per liter at a CaO concentration of about 0.07 gram per liter. Silica is taken up in excess of this amount to form a bluish or opalescent colloidal solution. Such a solution was made up containing 0.4550 gram SiO_2 and 0.0246 gram CaO per liter and was mixed with saturated limewater in various proportions to form a series of solutions. Analysis of these solutions and of the hydrated calcium silicates precipitated from them is expected to give important data on the system $CaO-SiO_2-H_2O$ at 30 deg. C.

Testing Durability of Cement by Titration in Sugar Solution

A method suggested by Merriman (*Eng. News-Record*, January 9, 1930) for predicting the durability of cement by means of a hydrochloric acid titration of the cement in a sugar solution was applied to a large number of cements in an attempt to discover any existing correlation between the titration values received and the actual resistance of the various cements to the action of sodium sulfate. In general, the cements having the higher "indices," that is, higher titration values, were found to be less resistant to the action of the sulfate solution. The correlation, however, was rather poor.

Publication: *"Can Cement Durability be Predicted?"* by E. T. Carlson and P. H. Bates; *Eng. News-Record*, **107**, pp. 130-2 (July 23, 1931).

Thermal Decomposition of Tricalcium Silicate

The behavior of tricalcium silicate at temperatures between 1000 and 1300 deg. C. was studied by determining the amount of free lime present in samples which had been held at various temperatures in this range for definite periods of time. The following facts were established:

1. Tricalcium silicate tends to dissociate into dicalcium silicate and lime when heated to temperatures between 1000 and 1300 deg. C.

2. The reaction takes place most rapidly at about 1175 deg. The samples studied liberated about 15% CaO on being heated for one day at this temperature.

3. The presence of either of the products of the reaction (dicalcium silicate and free lime) appears to be necessary to start the reaction.

4. Tricalcium silicate which has been exposed to the air for some time breaks down much more readily than the freshly burned material, probably because the moisture in the air reacts with the silicate, liberating lime, which then catalyzes the decomposition.

5. The presence of gypsum also facilitates the decomposition of tricalcium silicate, probably because the gypsum breaks down on heating, liberating lime.

Publication: "The Decomposition of Tricalcium Silicate in the Temperature Range 1000-1300 deg. C.," by E. T. Carlson; Bureau of Standards Journal of Research, Vol. 7, pp. 893-902 (November, 1931), Research Paper No. 381; Rock Products, Vol. 34, p 52 (December 5, 1931).

The Binary System $CaO-B_2O_3$

An investigation to determine the possibility of producing a well-burned cement clinker at a relatively low temperature by the use of a small quantity of boric acid as a flux has been undertaken.

Preliminary thermal studies on cements and dicalcium silicate containing boric acid indicated that the boric acid caused a lowering of the refractive indices of the dicalcium silicate, and also that it caused a lowering of the temperature of the beta-alpha transition of this compound. A study of phase equilibria in part of the ternary system $CaO-B_2O_3-SiO_2$ is to be undertaken, and as a preliminary to this, the binary system $CaO-B_2O_3$ is being studied. Four distinct compounds have been found, and their melting points determined approximately. The formulae and melting points are as follows: $CaO \cdot 2B_2O_3$, 990 deg. C.; $CaO \cdot B_2O_3$, 1150 deg. C.; $2CaO \cdot B_2O_3$, 1300 deg. C.; $3CaO \cdot B_2O_3$, 1480 deg. C. These points represent maxima on the melting point curve. Optical data for these compounds have been obtained, and the phase diagram of this binary system is being worked out.

Reaction of Water on the Calcium Aluminates and Calcium Aluminate Cements

It has been shown previously that the anhydrous calcium aluminates less basic than tricalcium aluminate, as well as calcium aluminate cements, reacted with water to form metastable monocalcium aluminate solutions in the early periods. The metastable solutions decomposed as the reaction proceeded with the precipitation of hydrated alumina and either the hexagonal or isometric form of hydrated tricalcium aluminate. Below 21-25 deg. C. the hexagonal form appears to be the stable phase and above 25 deg. C. the isometric form is stable, although the hexagonal form may at first appear and slowly revert to the isometric form. The composition of the calcium aluminate solutions resulting from the reaction of water on the anhydrous calcium aluminates and calcium aluminate cements fall within a well defined region in the phase diagram $CaO-Al_2O_3-H_2O$.

With an increase in temperature from 20 to 40 deg. C. there is an increase in the speed of the reaction between water and calcium aluminate cements, the metastable solutions reaching a maximum sooner and decreasing from this maximum more slowly. The maximum is also at a higher concentration. This increase in the quantity of cement reacted upon with an increase in temperature could be expressed by logarithmic relation. At the higher temperatures the isometric tricalcium aluminate hydrate is the stable phase and below 20 deg. C. the hexagonal form is stable.

There is a region more alkaline than that

wherein the reaction occurs during the reaction of water on the calcium aluminate in which hydrated tricalcium aluminate is precipitated free of hydrated alumina.

In a limited region in the system CaO-Al_2O_3-H_2O hydrated tetracalcium aluminate is the stable phase. Since its solubility and that of hydrated tricalcium aluminate are very low in the more alkaline region it is difficult to determine accurately the invariant point for these two solid phases. Likewise, since hydrated alumina undergoes a change with "aging," as evidenced by the petrographic miscroscope, it is difficult to fix the invariant point where hydrated alumina and hydrated tricalcium aluminate are in equilibrium with one another. Although some of the boundaries in the phase diagram CaO-Al_2O_3-H_2O have been determined, other fields need further investigation.

Temperature Rise in Cement Pastes During Hardening

The temperature rise of 50 different cements in the form of pastes showed that there was a marked difference in the cements in this respect. The conditions under which the hardening took place were empirical but easily reproducible and hence the data can be readily compared. The temperature rose during the first 24 hours from 21 deg. C. to as much as 90 deg. C.; the average rise was approximately 40 deg. C. and the minimum 15 deg. C.

While the chemical analyses showed that there was a general relation between the constitution and the temperature rise, there were rather numerous deviations from the general trend. The higher tricalcium silicate contents produced the higher temperature rise as a rule, but the minimum rise obtained was produced by a cement having 51% of this constituent, which would have been expected to have produced a rise well towards the maximum obtained.

The fineness of grinding and the presence of moisture very materially affected the rate of rise. The effect of the former was determined by obtaining the rise of pastes made from the cements composed of 50% of the sample as received and 50% retained on a 325 mesh sieve. In many cases the maximum rise was reduced about one-half. The introduction of 4% water into the sample as steam while the sample was at 105 deg. C. produced also about a 50% less temperature rise.

To study this question further, adiabatic calorimeters have been constructed in which fifteen 6 by 12 in. concrete cylinders can be stored at the same temperature as that which they will develop in their interior during hardening.

Hardening of Portland Cements at the Boiling Point of Water

The curing of portland cement products in steam has been a matter of interest for years. The behavior of portland cements of different characteristics to this type of curing is of interest to the makers, and, therefore, a short series of tests to obtain pertinent information was undertaken.

A plastic mortar of portland cement and run of mine Ottawa sand was prepared from four different cements and subjected to boiling water or at an atmosphere of steam for 16 hours within one-half hour after molding. The data so obtained, when compared with the results secured in testing the same mortar aged in a damp closet at 70 deg. F., show that the higher temperatures very materially increase the strengths at 24 hours, but at 7 and 28 days there is little or no difference in the strength. The different cements did not have the same relative increase in strength at the higher temperatures.

Publication: The results of these tests will be published shortly in an early issue of the *Journal* of the American Concrete Institute.

Testing of Cement

The bureau maintains branch laboratories at Northampton, Penn., Denver, Colo., and San Francisco, Calif. These laboratories sample, test, and inspect the shipment of cement. Inspection service is maintained at 70 mills throughout the United States. During the year samples representative of over 2,500,000 bbl. of cement were tested.

Cement Reference Laboratory

The Cement Reference Laboratory, a cooperative project of the Bureau and Committee C-1 of the American Society for Testing Materials, has continued its endeavors to promote uniformity and improvement in the testing of cement. The field inspection of laboratories has continued to be the major part of the work. During the year there was performed about 80% of the second inspection tour of cement laboratories. Since the completion of the first inspection tour in the latter part of 1930, there have been received requests for the inspection of 231 laboratories, of which laboratories 141 had been visited in the first tour. The laboratories involved in this second tour are distributed over 43 states.

The Bureau of Public Roads is utilizing this field inspection service by requiring that laboratories making acceptance tests of cement for use in federal aid projects shall furnish evidence of inspection by the Cement Reference Laboratory, and shall have such inspections made within certain time intervals.

The later inspection reports indicate that since the first tour there has been an improvement in apparatus and also an increase of interest in details of test methods and control of temperature. Data collected by the laboratory have been useful in cooperation with Committee C-1 on Cement, answering various inquiries, and dealing with some of the manufacturers of testing apparatus.

The investigation of methods of determining the size gradation has been carried on throughout the year in the endeavor to learn more of the possibilities of methods applicable to the study of the range of fineness below the particle sizes which can be determined by sieves.

A short 16 mm. film demonstrating cement testing methods has been prepared and has been used in some of the field inspections. This film can be borrowed by laboratories. Several universities have equipped their laboratories with copies of the film.

The field inspections of laboratories are still performed without charge. Requests for such inspections should be addressed to the Cement Reference Laboratory at the bureau.

A more detailed report of some of the laboratory's activities appears in the report of the subcommittee on Cement Reference Laboratory, report of Committee C-1 on Cement, in the 1931 Proceedings of the American Society for Testing Materials.

Resume of Investigations of Portland Cement Association Fellowship at the Bureau of Standards for the Year 1931

The purpose in all of the studies being conducted by this group is, first, to obtain fundamental information on the nature of cements and on the reactions which take place in the fabrication of concrete; and, second, to apply the findings of all basic research to the problems of the cement industry to the end of developing improvements in the concrete art which will lead to the production of structures more closely approaching the ideal in durability, flexibility and beauty in architectural design.

A large part of the time of this group during the past year has been given to a comprehensive investigation on effects, both in manufacture and in utilization, due to systematic variations in the composition of the clinker.

In this study commercial raw materials are used. These raw materials are proportioned in such a manner that the compound composition of the clinkers (*Ind. Eng. Chem.* (Analytical Edition) **1** (1929), 192; Rock Products, **32**, No. 23 (1929), 47) will vary along definitely prescribed directions. Thus, in one series, the tricalcium aluminate was caused to decrease by the systematic substitution of ferric oxide for alumina. The tenary compound, $4CaO \cdot Al_2O_3 \cdot Fe_2O_3$, increased as the $3CaO \cdot Al_2O_3$ decreased. Adjustments were made so that the other compounds of the cement remained substantially constant. By other methods of a similar character, each of the compounds in the cement was caused to vary in a prescribed manner. In this series, 61 clinkers have been made and about 8000 lb. of cement produced.

A special study of all of the compositions was made, with the use of an electric furnace, by burning at different temperatures and determining the extent of combination by means of the free lime test (*Ind. Eng. Chem.* (Analytical Edition), **2** (1930), 296). These tests indicate precisely the manner in

which the burnability of the raw materials is affected by the ultimate compound composition of the clinkers. It may be stated that the most important factor affecting burnability, provided the raw material is ground sufficiently fine, is the ratio of $3CaO \cdot SiO_2$ to $2CaO \cdot SiO_2$. Likewise, the amount of alumina and iron-containing compounds, as well as their ratio, influences the burnability.

The tests which are being made on the cements of this investigation include studies on the volume changes of especially prepared specimens submitted to exposure in water, in air, and in certain salt solutions, and the heat evolved during the early hardening period. At the Chicago laboratory of the Portland Cement Association all of the usual tests on cements are being made, including normal consistency, size distribution, soundness, time of set, tensile strength of briquets, compressive strengths of 2-in. mortar cubes and 3- by 6-in. concrete cylinders, and resistance to freezing and thawing of 2-in. mortar cubes. Concrete specimens furthermore are being measured for volume change under various conditions of exposure.

Although most of the cements for this series have been made, the preparation of specimens for various tests has not been completed; consequently a report covering the results of such tests cannot be made at this time.

The studies that are being conducted on the heat liberated by the cements above described are of particular interest at this time due to the demand by engineers for information by which the heat liberated from any given cement may be computed with reasonable precision. Such information is necessary in order that certain large structures of mass concrete may be designed to avoid extensive volume changes which might result due to large temperature changes during the hardening of the concrete.

A new investigation has been planned in which the variables due to the heat treatment of the clinker in the kiln and to the cooling process will be studied. It is planned to examine the effects of different temperatures and time periods of burning and of various methods that are or may be employed in the cooling of the clinker. The structure of the resulting clinkers will be examined in thin sections by the microscope and in powder by the x-ray diffraction method. Observed differences in structure will be correlated with experimental differences which may be noted in the properties of the cements. The properties to be studied will include many of those referred to above which have been examined in the investigation where composition was the chief variable.

Cast Stone

The investigation of the physical properties of cast stone has been completed during the year. There were large differences in quality between the samples. The strongest specimen had a strength of 21,700 lb./in.^{2}, the weakest 1550 lb./in.^{2} The 48-hour absorption varied from 2.0 to 13.1% of the dry weight of the sample. Last year 1350 cycles of freezing and thawing was the greatest number withstood by any specimen before signs of disintegration appeared. This year the most resistant specimen finally showed slight signs of disintegration at the 1450th cycle. Comparing this value to the values of 22 cycles for first signs of failure and complete failure in 25 cycles obtained on the least resistant specimen, an excellent concept of the wide range in quality of the cast stone samples may be gained.

The correlation between the resistance to freezing and the other physical properties was very poor. Because of this poor correlation a number of detail requirements had to be incorporated in the specification. The requirements adopted in the specifications, however, assured that any sample will very probably be of good quality. A strength requirement of 5000 lb./in.^{2}, a 48-hour absorption limit of 8%, and a maximum 5-hour boil absorption of 11% eliminated a large portion of the poor weathering specimens. Schurecht's proposal of the use of the ratio of the 48-hour water absorption to the absorption due to the subsequent 5-hour boiling as a criterion for weather resistance was studied. A Schurecht ratio limit of between 0.6 and 0.9 for specimens with a 48-hour water absorption greater than 6% was found to be the only criterion that would eliminate a number of the poorer specimens. The specifications as written eliminated all specimens showing a weather resistance of less than 113 mean weathering cycles, and all but two of the 28 specimens with a resistance of less than 280 cycles.

Publication: "The Physical Properties of Cast Stone," by John Tucker, Jr., G. W. Walker and J. Arthur Swenson; Bureau of Standards Journal of Research, Vol. 7, No. 6 (December, 1931), Research Paper No. 389; Journal of the American Concrete Institute, Vol. 3, No. 4, pp. 243-264 (December, 1931).

Waterproofing Agents for Concrete

During the year this investigation of the effect of waterproofing materials on concrete was completed and the results have been published in the December, 1931, issue of the Bureau of Standards Journal of Research as well as in the December issue of the Journal of the American Concrete Institute.

This study emphasizes the fact that it is a difficult matter to demonstrate in the laboratory the value of waterproofing materials. Good concrete made in the laboratory, as well as good concrete made in the field and properly placed, is practically impervious to water. The leakage is generally found where the concrete has become segregated, leaving a concrete lean in cement paste. Therefore, in this study of the effects of integral waterproofing materials a 1:3:6 mix was used that was assumed to be similar to this segregated portion. Some few of the integral waterproofing materials so tested caused the treated concrete to be less permeable than plain concrete of the same quality. The majority did not materially decrease the permeability.

In the study of surface waterproofing materials a 1:2:4 mix was used. Cured concrete cylinders were coated with the several waterproofings and the absorption obtained at regular intervals over a period of a year. Such materials as asphalt emulsions and asphalt paints were quite effective. The most efficient transparent coatings tested were linseed oil, china wood oil, and varnish. Practically all of the surface coatings tested were less absorbent than the uncoated concrete for the first few hours of immersion in water.

Publication: "Tests of Integral and Surface Waterproofings for Concrete," by C. H. Jumper; Bureau of Standards Journal of Research, Vol. 7, No. 6 (December, 1931), Research Paper No. 394; Journal of the American Concrete Institute, Vol. 3, No. 4 (December, 1931).

Clays as Admixtures in Concrete

The investigation of the value of clay as an admixture in concrete, sponsored by Hugh L. Cooper and Co., has been continued during the year to the extent of testing specimens as they became two years of age. Compressive strength, absorption, and permeability tests have now been made on specimens aged for three and nine months, and one and two years. The results afford comparisons of these properties for three types of concrete, one without an admixture, another of a similar composition except that clay replaced 10% of the volume of the cement, and a third in which clay was substituted for 7½% of the volume of the sand.

Three complete sets of specimens were made using three different brands of cement. In addition, three complete sets of those containing clay were made using three different clays. Both the cements and the clays were selected to give a range in their plastic or working properties. All of the specimens were aged for 28 days in the high humidity concrete storage rooms at a temperature of 70 deg. F. ± 2 deg. After this period one-half of the total number were exposed to weathering outdoors and the rest to cycles of freezing in air and thawing in water.

The substitution of clay for 10% of the volume of the cement resulted in concretes having approximately the same strength as the concrete without clay. Substituting clay for 7½% of the volume of the sand resulted in a small but consistent increase in strength at all ages up to and including two years.

The freezing and thawing exposure did not cause the disintegration of specimens that were kept damp, and the strengths of these specimens made with portland cements increased with age. However, the specimens used in the absorption tests and which were dried once at each of the ages of 3, 6, 9, 12 and 24 months, were all completely disintegrated. On the average, the specimens made with a rapid hardening cement disintegrated more rapidly when subjected to the freezing and thawing and occasional drying than did

those which were made with portland cements.

The water absorptions of the concretes containing clay were slightly greater than those without an admixture, but the difference was too small to be significant.

Admixtures of clay reduced the permeability of the concrete at early ages. The reduction was not large for the concretes in which clay replaced 10% by volume of the cement, but was appreciable for those in which clay was substituted for 7½% of the sand. However, at the age of one year the permeability of the concretes containing clay was approximately the same as those without clay.

Cinder Aggregates

Fifty-nine samples of cinder aggregates were obtained from 48 plants manufacturing cinder concrete building units for an investigation of the grading, weight per cubic foot, hardness and soundness of such aggregates used in the industry. The weights of the aggregates when in the dry rodded condition as described in the "Standard Method of Test for Unit Weight of Aggregate for Concrete (C29-27)" of the American Society for Testing Materials ranged from 46 to 77 lb. per cu. ft. The fineness moduli of the aggregates ranged from 2.9 to 5.4.

As a measure of the hardness of the cinders, 2500 grams of the particles of each sample retained on a No. 8 sieve were ground in a ball mill under standardized conditions. The percentage of each which was retained on a No. 8 sieve after the test was taken as a measure of hardness. These values ranged from 17 to 65% for cinders from bituminous coal and from 2 to 21% for cinders from anthracite coals. There appeared to be no consistent relation between the hardness of the cinders, as determined by the ball mill test, and a classification of source, such as: industrial plant, electric power plant and railroad or of method of firing, mechanical or hand.

Soundness tests were made by the pat test method devised by the Building Research Board of Great Britain and described in its Technical Paper No. 7, "Investigations on Breeze and Clinker Aggregates." Mortars composed of three parts by volume of finely ground aggregate and one volume of a mixture of equal parts by weight of plaster of paris and portland cement were mixed to a plastic consistency and molded on glass plates into pats 3 in. in diameter and 0.5 in. high. The pats were kept in moist atmosphere for three to four hours and then immersed in water. If the pats cracked or curled within four days it was considered that the aggregate was likely to be unsuited for use in building construction. None of the aggregates submitted failed in this test.

Researches on the Properties of Masonry Mortars

An investigation of the physical properties of mortars typical of those used in building construction has indicated two different relations' ips that may be of value. One of these is applicable to freshly made mortars and the other pertains to the hardened mortars.

The first relates the water-retaining capacity of the mortar to its resistance to deformation such as is measurable, for instance, with a flow table. This relationship indicates that the property of the freshly made mortar to resist loss of water may possibly be an index of its plasticity. The "flow curve" of a mortar is obtained by plotting the flows (per cent.) against the percentages of mixing water, computed on the basis of total dry weight of materials, i.e., sand and cementing material. The water-retaining capacity of the mortar is obtained by holding it on a standard suction device for different time intervals. From the data, loss of water is plotted versus time. The two curves from these two sets of data may be combined. From the flow curve, the flow at the end of any given time on the standard suction device (standard porous base) may be computed; and the amount of the initial water retained by the mortar at the time in question being also known from the per cent. water loss-time relation, a curve, showing the change of the flow with respect to time, is obtained.

The general shape of the flow versus time curves is very similar to that of curves plotted from data obtained with the Emley plasticimeter.

The degree of variation among different mortars when studied from this standpoint is quite large. Some stiffen quickly, attaining a flow of 40 or less within one minute. Other mortars require from 7 to 10 minutes on the standard porous base to reach this condition.

The second relationship of possible importance is the ratio of the extensibility of a hardened mortar specimen to the maximum volume change which accompanies wetting and drying under what may be considered as normal conditions.

The moduli of rupture and elasticity are simultaneously obtained by center loading of a 1 by 4 by 12 in. specimen. The span is 10 in., and as constant load increments are applied, dial readings, indicating the deflection of the specimen at each respective load are recorded until breaking occurs. The ratio, modulus of rupture to modulus of elasticity, multiplied by 100, gives the deformation of this type in terms of inches per 100 in. which the specimen undergoes at the breaking load. Calling the value $\frac{M.R.}{M.E.} \times 100 = e$, and v = the maximum volume change occurring as a consequence of normal variation of the moisture content of the specimen, the ratio, e/v, is obtained. The e/v values range from 0.19 to 14.0 for different mortars. However, the degree of variation of e among the various mortars studied has been much less than that of v.

It will be noted that in the proportion, e to v, three properties of hardened mortars are correlated. These are the moduli of rupture and elasticity and the volume change which the mortar is capable of undergoing under normal conditions of drying and wetting.

It is planned to make use of these data in later studies dealing with brick and mortar combinations.

Volume Changes in Brick Masonry Materials

The expansion and contraction of mortars and of bricks caused by changes in moisture content and in temperature were studied in an investigation carried out with the cooperation of the American Face Brick Association. The cementing materials for the mortars included 11 different brands of portland cement, 7 limes, and 10 masonry cements. Bricks from 8 plants were included.

Mortars composed of one part of cementing material to three parts of sand by volume were made with each of the cements and limes. With a few of the cementing materials, 1:4 mortars were made and also 1:1:6, 1:1:8, and 1:2:9 mixtures of cement, lime, and sand. The water content of all mortars was that required for "standard consistency" as defined in the Federal Specification (SS-C-181) for masonry cement.

The shrinkages of mortars during early hardening were measured on 1 by 1 by 10 in. mortar bars, which were stored in air at normal room temperature and humidity. Observations were made at 2 days and at 10 days after molding. The shrinkages of the 1:3 mortars during 10 days ranged from 0.37 to 0.64% with the lime mortars, 0.21 to 1.11% with the masonry mortars, and 0.11 to 0.30% with the portland cement mortars. Increasing the proportion of sand in the mortars decreased the shrinkage during hardening. The shrinkage of mortars containing cement and lime was increased as the lime content increased, but was less than for lime mortars. Additions of 2% of calcium stearate by weight of the cement to mortars did not affect the shrinkage appreciably.

Measurements of the expansion and contraction of mortars during cycles of wetting and drying were made on 1 by 5 by 23 in. slabs. The specimens of portland cement and of masonry cement mortars, when 48 hours old, were kept in water at 21 deg. C. for three months. They were then dried to constant length in air at 38 deg. C. and 20 to 25% relative humidity. The three months soaking and the drying was repeated once. The slabs of lime mortar were stored in air for three months, then kept damp for three months by daily sprinkling while in a high humidity chamber. They were then subjected to a cycle of drying and wetting similar to that for portland and masonry cement mortars, except that the bars were partially instead of completely immersed during soaking.

The mortars of portland or masonry cement contracted during drying and expanded during soaking. The changes in length due either to drying after three months soaking or to soaking for three months after drying

usually ranged, for the different cementing materials, from 0.5 to 1.0% with the portland cement mortars and from 0.4 to 1.0% with the masonry cement mortars. The expansion and contraction of the lime mortars due to wetting and drying after hardening were markedly less than for the cement mortars. Some of the lime mortars showed a tendency to expand somewhat during drying as well as during soaking. Substitutions of lime for part of the cement in cement mortars, or increasing the proportion of sand, decreased the volume changes of the hardened mortars. Additions of calcium stearate appeared to decrease the time rates of expansions on wetting and of contractions on drying, but did not affect materially the final amounts.

The expansions of the bricks during one month of immersion in water ranged from 0.0 to 0.025%. The well-burned bricks expanded much less than relatively soft-burned bricks from the same plant. The bricks did not change in length during drying.

The coefficients of thermal expansion in millionths per degree C. ranged usually from 7 to 9 for the lime mortars, 7 to 11 for the portland cement mortars, 6 to 11 for the masonry cement mortars, and 8 to 9 for the cement-lime mortars. The corresponding values for the bricks were usually between 4 and 8 millionths per degree C.

Publication: "Volume Changes in Brick Masonry Materials," by L. A. Palmer; Bureau of Standards Journal of Research, Vol. 6, No. 6, p. 1003 (June, 1930), Research Paper No. 321; Rock Products, Vol. 34, No. 15, p. 44 (July 18, 1931).

Water Penetration in Brickwork

The rates of water penetration into brick and mortar specimens separately were compared with the rates of penetration into assemblages of bricks and mortars. Bricks which absorbed water with exceptional rapidity were selected for the tests, in order that the results would give an indication of the maximum rates of water penetration into brickwork. Three mortars composed of portland cement and sand in the volume ratios of 1:2, 1:4, and 1:6, respectively, were used.

Specimens of brick and those of mortar, both of the size of whole bricks, were exposed along a vertical face to water under pressure, and the time required for water to penetrate a distance of 3.75 in. to the opposite face was noted. The average head of the water was 1⅛ in., equal to one-half the thickness of a brick. Assemblages of either two or four bricks with ½-in. thick mortar joints were similarly exposed to water under heads ranging from 0 to 8 in.

The time required for water to penetrate equal distances in the assemblages was much greater than in either the bricks or the mortar. There was a distinct lag in the rate of water penetration as the water passed from one material to the other, indicating that there was not a continuity of the pores from the bricks into the mortar.

Publication: "Water Penetration Through Brick-Mortar Assemblages," by L. A. Palmer; Journal of the Clay Products Institute of America, Vol. 1, p. 19 (September, 1931); Rock Products, Vol. 34, No. 24, p. 34 (November 21, 1931).

Reinforced Brickwork

In cooperation with the Common Brick Manufacturers' Association 18 beams of reinforced brickwork were tested to determine the resistance of the brickwork to diagonal tensile stresses.

The beams were 14 ft. long and about 1 ft. square in cross section. Nine of the beams were built with common brick from Chicago and the other nine with common brick from Philadelphia. In one type of beam the bricks were laid in common American bond as in a 12½-in. wall; in another the bonding was similar to that in a lintel beam with a soldier course forming the lower portion of each face of the beam, over which were laid two stretcher courses. The third type was built on end with vertical reinforcements to resemble a portion of a 12½-in. retaining wall with all bricks laid as stretchers. A 1:3 portland cement-sand mortar, with an addition of lime equal to 15% of the volume of the cement, was used for all beams. Each beam contained six ½-in. square bars as tensile reinforcements.

A load test was made by supporting the beam on a span of 12 ft. and applying equal loads at the quarter points of the span. First the load was increased by small increments until the deformations indicated that the maximum stress in the steel was at least 15,000 lb./in.^{2} Then the load was reduced to a total of 1000 lb., and finally increased by small increments until failure occurred. The set remaining after the first loading was roughly one-fifth of the maximum deformations before reducing the load, which is of the same order of magnitude as has been observed with reinforced concrete beams of about the same initial stiffness.

Cracks which tended to follow diagonal planes between the contacts with the beams of the supports and the nearer loads, formed before the failures of the beams took place. In some instances they passed through the bricks, their locations apparently being unaffected by the mortar joints; while in others the mortar joints were opened along an irregular line extending from a support toward the nearer load. The maximum shearing stresses ranged from 60 to 160 lb./in.^{2}, the values depending chiefly upon the kind of brick and their bonding in the beams.

Tests are now under way to determine the strength of the bond between mortar and bricks similar to those used in the beams.

Strength of Steel Columns Encased in Brickwork

Nine steel columns, six being encased in brickwork, were tested to determine the relative strengths of the unencased and the encased steel columns. The columns were of 6-in. Bethlehem H-section weighing 20 lb. per ft., and were 23 ft. long. The slenderness ratio (length divided by least radius of gyration) for the unencased columns and for the steel in the encased columns was 185.

The brick walls encasing the six steel columns were 14 in. thick, 6 ft. long and about 22 ft. high, leaving the steel projecting about 8 in. above the upper surface of the brickwork. In three of these specimens the webs of the H-sections were parallel with the faces of the wall, and in the other three at right angles to them. The bricks were set in a mortar composed of one part of portland cement and three parts sand by volume, with an addition of hydrated lime equal to 10% of the weight of the cement. The encased columns were tested about 30 days after the completion of the brickwork.

The columns were tested in a vertical hydraulic testing machine with their flat ends bearing against machined steel plates in contact with the platens of the machine. The loads were increased by increments until failure occurred. Auxiliary tests were made to determine the tensile properties of coupon specimens cut from the steel columns and the compressive strength of H-sections having a length equal to the unencased portions of the steel of the encased columns.

The unencased columns failed at mid-length by lateral deflection in the direction of the least radius of gyration, with no sign of secondary failures. The average strength was 23,300 lb./in.^{2} The encased columns failed by local buckling in the unencased portion of the H-section, under an average load of 40,700 lb./in.^{2} of steel area. Strains in the steel, measured at mid-height of the columns, indicated that the stresses in the encased columns were 18% of those in the unencased columns for the same loads. The strength of the encased columns was equal to the tensile yield point of the coupon specimens and was also equal to the compressive strength of the H-sections having a length equal to the unencased portions.

Load Test of a "Natcoflor" Slab

The "Natcoflor System" is a one-way reinforced type of combination hollow tile and concrete floor slab construction. It consists of rows of special shaped tiles with cement grout joists 2 in. wide spaced 13 in. center to center between the tile rows. Each joist is reinforced with steel bars. There is no concrete topping over the tiles and the compressive stresses are borne by the grout joists and the tiles.

A "Natcoflor" slab 6½ ft. wide, 37 ft. long and 8 in. thick was erected on three concrete piers, the clear span between the piers being 17½ ft. Each joist contained a ⅝-in. diameter round bar and a ½-in. square bar for resisting tensile stresses in portions of the slab subjected to positive bending moments. The ½-in. square bars were bent up to lie near the upper surface of the slab in regions of negative bending moment. The grout was composed of one part portland cement to 2½ parts of sand by volume, with

sufficient water to give a consistency suitable for pouring into the 2-in. spaces between the rows of tiles.

When the slab was 39 days old it was loaded with pig iron until failure occurred. Under a load of 172 lb. per sq. ft. the maximum deflection of the slab was 0.47 in., indicating that the stiffness of the floor was about the same as a reinforced concrete slab of the same dimensions. The tensile reinforcement over the central pier began to yield when the load on the slab was between 200 and 230 lb. per sq. ft. and failure occurred under a load of 300 lb. per sq. ft. It was indicated that the maximum resisting moment was approximately 10,000 lb. ft. per foot width of slab.

Volumetric Changes of Gypsum Fiber Concrete

Gypsum fiber concrete is the term applied to a hardened conglomerate mass resulting from the setting of a mixture of calcined gypsum, wood chips, and water. While it is not directly exposed to weather in use, there is no assurance that it will remain always dry. Therefore an investigation was made to study the volume changes which it undergoes in setting and those which result subsequently from variations in moisture content. Five different gypsums were used and measurements made on neat as well as on those containing the wood chips.

After the setting measurements, thermal expansion measurements were made on the specimens of one plaster. All the specimens were then divided into two groups. Those of one group were alternately dried and then soaked in water 14 times. The other specimens were exposed alternately to air of high and low relative humidity. Ten of these cycles were carried out.

The results of the expansion during setting measurements gave the following conclusions:

1. Different plasters gave widely different expansions. The neat mix giving the highest expansion at testing consistency was 50% greater than the lowest under the same conditions.

2. An increase in amount of wood chips or a decrease in amount of mixing water used resulted in increased expansions.

The measurement of thermal expansion made with specimens of one calcined gypsum showed the coefficient of thermal expansion per degree C. (27 to 47 deg. C.) ranged from an average maximum of 16×10^{-6} for neat specimens to an average of 13×10^{-6} for specimens containing 12.5% of wood chips.

Measurement of the specimens during the week after casting showed that the expansions due to setting continued for at least 24 hours if the water was allowed to remain in the pores of the concrete. After that time a contraction in length took place when the specimens were allowed to dry out.

The continued alternations of drying and soaking resulted in a gradual increase in length from cycle to cycle. Alternate exposures to air of high and low humidity produced a gradual contraction from cycle to cycle after the first few cycles.

The magnitude of the changes produced by soaking were much greater than those resulting from exposure to moist air. An increase of the percentage of wood chips or a decrease of the amount of mixing water resulted in specimens which gave greater changes in length when soaked or exposed to moist air.

Heat of Solution of Calcium Sulphate and Its Hydrates

The existing data on the heats of hydration of calcium sulphate were obtained many years ago on materials of rather questionable purity. Better and more complete data are needed to calculate the efficiency of the gypsum calciners and for a better understanding of the reactions involved in the setting of plaster.

By determining the heat of solution of calcium sulphate and its hydrates in a suitable solvent, thermochemical data can be obtained for calculating the energy changes involved in passing from one modification or hydrate to another. If the differences in the heats of solution of two phases can be measured it is not necessary to measure the actual heat of solution of the separate phases.

Accordingly, a twin calorimeter was designed to measure these differences in heat of solution of calcium sulphate and its separate hydrates, which were prepared in a very pure state. It was found that a solution of ammonium acetate was a suitable solvent.

The calorimeters have been tested out by measuring the heat of solution of material of which the values are known, indicating that a few minor changes may be required before final data of the desired accuracy are obtained.

Particle Size Distribution of Lime

A device has been assembled which will continuously record the increase or decrease in weight of a body. With this device the rate of settling of suspensions of limes can be determined, from which the particle size distribution of the lime can be calculated. In order to check this method of determining particle size, some very fine glass spherules were made. Pyrex glass was ground until it had approximately the same particle size as lime. This glass was blown through the flame of a blast lamp where it was fused and came out as perfect spheres. In order to facilitate the microscopic measurement of the particle size of this finer powder, and also to check the sedimentation of various size particles, the glass spherules were separated into various size fractions. An attempt was made to obtain these fractions with an elutriator, but the separation was not as sharp as desired, so the material was separated by sedimentation. The glass was dispersed in alcohol and allowed to settle a definite length of time, after which the finer particles were siphoned off and the coarser ones left behind. In this manner the glass was separated into accurately fractionated sizes. The glass was handled and separated in alcohol. It was found necessary to keep the glass in alcohol after it had once been wet, because it was impossible to completely disperse the glass again if it was once allowed to dry out.

The particle size of each fraction of the glass spherules could then be determined very accurately with a micro-projector. Since the particles were spherical, there was no uncertainty in determining the average diameter of the particles, and since the range of size of each fraction was small, there was little uncertainty that a representative sample was obtained. The particle size was then obtained by the use of the sedimentation apparatus. The results of the determination for the coarser fractions agreed very well, but the sedimentation apparatus gave considerably larger values for the finer fractions, as is shown below.

	Fraction			
Size, in microns	A	B	C	D
By sedimentation	9.9	6.5	4.4	2.4
By the microscope	9.8	6.3	3.4	1.8

Regarding the particle size of lime, some broad generalizations may be stated. Of the limes investigated so far, the amount of material finer than 20 microns varied from 98 to 73%. The amount of material finer than 5 microns varied from 45 to 14%. Since 20 microns is less than one-third the size opening of a No. 200 sieve, it is evident that a screen analysis of lime would be of little value in determining the particle size or distribution of lime.

The Results of Freezing and Thawing Tests on Sand-Lime Brick

Since the resistance of brick to freezing and thawing is very important, and since this property cannot be measured directly, it has been a custom to include absorption requirements in specifications on the assumption that this property was a measure of weather resistance. In order to determine the importance of absorption requirements in specifications for sand-lime brick as a measure of weather resistance, 22 sets of 10 half brick each, having various absorption properties previously determined, were subjected to 50 alternate cycles of freezing and thawing. The following were the conclusions reached:

1. In general, among brick of one make, those lowest in total absorption were those which withstood alternate freezing and thawing most satisfactorily.

2. Freezing and thawing was attended by an increase in compressive strength of those sand-lime brick which survived such tests.

3. Any relations which may have existed between total absorption of a brick and its resistance to freezing and thawing were obscured when the data obtained with all the makes of brick were considered. This lack of relation was equally apparent whether the absorption on a percentage or on a concentration basis is considered.

4. Neither Schurecht's nor Palmer's modification of Kreuger's ratio was in any way

definitely related to the resistance to freezing and thawing of the sand-lime bricks studied.

5. As a rule, sand-lime brick which had a rapid rate of absorption and high strength withstood freezing and thawing relatively satisfactorily. This statement is without reference to total absorption.

6. Whether there is or is not any relation between the ability of a brick to withstand the freezing and thawing test and its serviceability when exposed to weather, the data show that there is no relation between its ability to withstand the freezing and thawing test and the amount of water it will absorb. There is, therefore, no reason for continuing the requirement as to total absorption in specifications for sand-lime brick. The use of a requirement as to rate of absorption might well be considered.

Publication: "The Results of Freezing and Thawing Tests on Sand-Lme Brick," by H. F. McMurdie; Rock Products, Vol. 34, No. 12, p. 53 (June 6, 1931).

Slate Investigation

To summarize the investigational work on slate, materials from two quarries in Maine, seven quarries in Vermont, 32 quarries in Pennsylvania, three quarries in Virginia, and one each from Maryland, Tennessee, Georgia and Arkansas were studied. Several quarries supplied a large number of samples representing various grades, varieties, or beds. One quarry in an important slate producing district supplied samples from each of 39 beds, in order to determine what variations in quality might occur. Since the beds are in a vertical position, the results form a basis of determining later how the quality of the slate changes as the quarry reaches a greater depth. The results also have a value in relation to slate produced by other quarries working the same beds. In all, 343 samples were tested in this investigation. A considerable number were taken from the roofs of old buildings in order to gain some information on weathering qualities. Some of these had been exposed to the weather for more than 100 years and found to be in good condition. Others were found in an advanced state of decay after 25 years of service. The determinations of characteristics which make for permanence and those which lead to early decay were the most important phases of this work. The objective was not merely to determine which regions produce the best slate, but to devise a definite means of distinguishing good and poor materials no matter what the source might be. In order to do that it was necessary to determine the major cause of slate decay. The disintegration has been fairly definitely pinned to a physico-chemical process which takes place in slates having considerable amounts of calcite and pyrite impurities. Although this action was mentioned last year, it may be of interest to state that later research has more firmly established it as the true cause of slate decay. A slate has recently come to light which has a considerable amount of calcite but practically no pyrite, and this gives evidence of being a quite durable material. What appears to be the most reliable test procedure for determining the weathering qualities of a given slate is a soaking and drying test. In this the sample is soaked for about 17 hours in water at room temperatures and dried for seven hours in an oven at about 110 deg. C. The poor quality materials begin to decay in about 30 cycles of the test. Unfortunately, this requires a month or more for the test, hence a shorter determination is desirable in many cases. For materials which are known to contain the two harmful mineral impurities one may employ a shorter test with good results. This consists in immersing the sample for seven days in a 1% sulphuric acid bath and determining if decay occurs. The depth of decay may be used as a criterion for comparison. This treatment produces the same action on the type of slates to which it is applicable as actual weathering.

Other phases of the slate investigation relate to strength, hardness, toughness, density, elasticity, and absorption. A considerable range in strength was found for the various regions. Modulus of rupture values as low as 4000 lb./in.^{2} were obtained on some samples, while others were almost four times as great. The range indicated for hardness was comparatively small. The Ha values ranged from 6.5 to 11.8. Toughness was considered as the greatest amount a specimen 16 in. long and $\frac{1}{16}$ in. thick will bend before breaking. The highest values found were nearly 0.25 in. and the lowest about half that amount. The range in bulk density is small compared to other types of rocks, being from 2.75 to 2.89. This indicates weights per cubic foot of from 172 to 180 lb. Some slates show a marked difference in strength when tested with or across the grain, but others are of practically the same strength in both directions. Most slates are considerably weaker in the wet condition than in the dry.

A remarkable feature in relation to the durability of slate is the fact that some varieties may "weather" indoors. Cases can be cited where a slate has decayed which has not been exposed to any of the usual weathering agents. The underlying causes are evidently the same as already stated for outdoors. All that is necessary to bring about this action is the presence of air and moisture, although the heat of the sun's rays and soaking by rains greatly accelerates the process. Cases of interior slate showing decay are, no doubt, extremely rare, and the above statement should not be viewed with alarm.

Roofing Slate Specification

Through cooperation with the Federal Specifications Board a quality specification has been devised for roofing slate. This was based largely on the investigation described above. Although the specification has not been finally adopted or made mandatory for Federal Government purchases, it is being used tentatively in one form or another by different departments and some state governments. It recognizes three grades of quality and the various requirements are as follows:

ROOFING SLATE SPECIFICATIONS

	Grade A	Grade B	Grade C
Average modulus of rupture (lb./in.^{2}) not less than	9500 lb.	8500 lb.	7500 lb.
Average absorption by weight not more than	0.25%	0.35%	0.45%
Sulphuric acid test, average depth of softening not more than	0.002 in.	0.015 in.	0.020 in

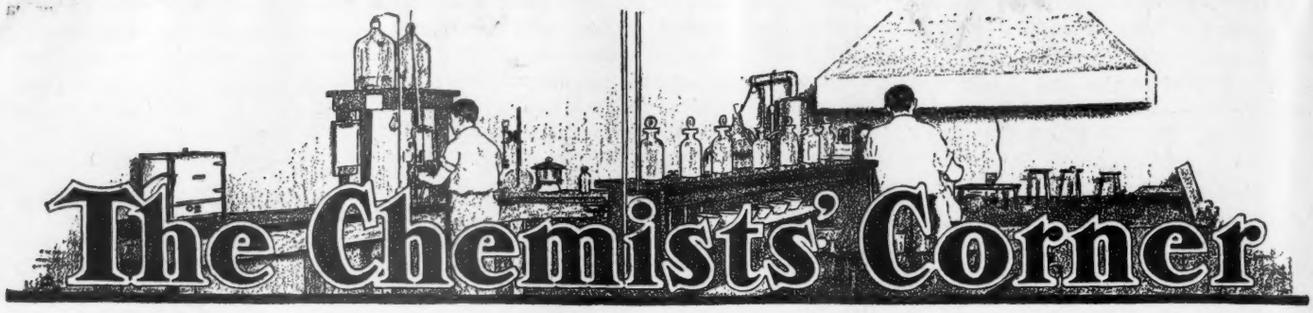
The greatest difficulty in establishing this specification has been in obtaining an acceptance by the producers. Following the general policy of the Federal Specifications Board, every effort is being made to make the specification as fair to all producers as possible without jeopardizing the rights of the purchaser.

Two features of roofing slate have been sources of disagreement in the acceptance of this specification. One relates to ribbons and the other to fading. It has been the desire of the technical committee to leave out all reference to these points under general requirements but let the purchaser in each case state as a special requirement whether a clear slate or an unfading slate is desired. This assumes that the general quality requirements will stand on their own merits and obtain durable materials. Specifically it means that if a ribbon slate can pass the general requirements of grade A or grade B it will prove satisfactory from the point of durability. It seems perfectly logical that in certain classes of buildings the presence of ribbons would not prove objectionable so long as the slate is durable. Likewise, a fading slate could be used in some cases where the appearance is not a matter of concern. For such reasons the technical committee proposed to eliminate all reference to these features under general requirements. However, after further consideration, "grade A" was required to be free from all ribbons, while all other grades permitted ribbons, providing the slate met the other quality clauses. With the three grade, or really four grade, division, including one sub-grade, the specification is sufficiently flexible to permit the purchaser to obtain a quality of slate suitable for his purpose. The greatest difficulty may be in securing a fair degree of competition in all grades. In cases where competition within one grade seems to be limited, the difficulty may be largely overcome by placing it in competition with an adjoining grade as an alternate.

Miscellaneous Problems

The study of frost resistance of various types of stone is still in progress and indicates that sound materials absorbing less than 2% water are practically free from frost effects. The work on stone preservatives and on abrasive hardness of stones used for floor treads, steps, etc., has been continued.

Numerous tests have been made on elastic pointing materials, slaters' cements, etc., by the Bureau during the past year.



The Determination of the True Lime Value in Raw Mix or Similar Materials

By Donald C. Paquet
Seattle, Washington

THE August 2, 1930, issue of ROCK PRODUCTS contained a very interesting article by Robert R. King dealing with the error introduced by the use of fusion mixtures in the preliminary decomposition of raw mixes prior to the main analysis for the determination of lime. The evidence as presented by Mr. King was conclusive and was later confirmed in principle by this writer.

The determination of lime in raw mixes and slurries should be as accurate and precise as it is possible to make it, consistent with speed and economy; for upon this determination rests, in the main, the burden of proper control. This writer had been using a measured but not weighed amount of fusion mixture up to that time, merely attempting to duplicate approximately the same amount of mixture used for each determination. Standardizing on the actual amount used solved the difficulty only so far as it might produce consistent results.

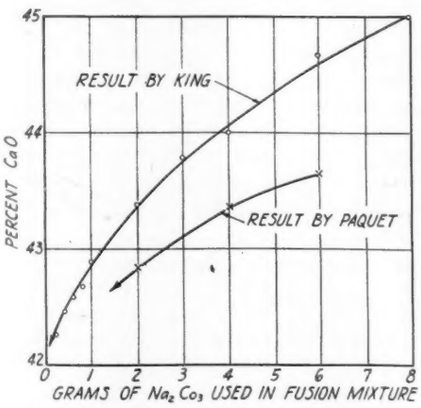
Using Mr. King's published figures, also a series determined by the writer, an interesting graph was produced indicating the probable true lime value of a given sample of raw mix. The error which might be introduced by careless application of the general use of fusion mixtures is indeed startling. Working on the general theory that in the case of an acknowledged error existing it is better to eliminate the error entirely rather than to endeavor to minimize it or use a predetermined correction factor, the writer worked out the procedure described below as a solution. This has been found to meet the requirements of speed and precision, and may also be applied to classes of materials such as flue dusts, argillaceous limestones, etc., ordinarily requiring solution by fusion procedure.

This method parallels to some extent the standard method outlined for limestones as published by the A. S. T. M.

Method of Procedure

The dry materials in the amount of 0.5 gram and ground to pass a 100-mesh screen is weighed into a 250-c.c. beaker. To this is added 10 c.c. of water in such a way that the mass of the sample is disturbed as little as possible, particularly if high in carbonate. The beaker is then covered and 5 c.c. of concentrated HCl is slowly poured in at the lip of the beaker. As the action progresses the beaker is lightly shaken. Digest on the warm part of the stove until the first violent reaction has been completed and then bring to a slow boil for 3 to 5 minutes. Filter into a 250-c.c. beaker, washing the paper once with warm water. Transfer the paper with insoluble residue to a platinum crucible and ignite in the muffle at about 1000 deg. C. for 10 minutes. The funnel in which the filtration was made is rinsed into the filtrate and the uncovered solution is evaporated on the stove at a point where there will be no danger of the residue spitting as it approaches dryness.

To the residue in the platinum crucible after cooling is added 1-2 c.c. of water, 5-7 c.c. HF, and three drops of concentrated H_2SO_4. Place on the stove so that steady evaporation takes place without boiling. When fumes of sulphuric begin to appear move to the hottest part of the stove and drive off all HF and H_2SO_4. Do not ignite. Cool, fill the crucible two-thirds full of 1-2 HCl, cover with a watch glass and boil gently for 5 minutes. Wash the cover glass and the solution from the crucible into the first filtrate beaker, using as little wash water as possible. Evaporate to dryness and bake only long enough to dehydrate whatever silica has been dissolved in the first acid solution. Cool, digest with just enough concentrated HCl to saturate the residue, and dilute to 50 c.c. The ammonia group is precipitated and filtered off with the silica and discarded. The lime is precipitated from the filtrate as oxalate and determined either gravimetrically or with permanganate.



Relation between amount of sodium carbonate in fusion mixture and resulting CaO values

The method of determination by which the sample is first converted to clinker works very well but necessitates the use of a high temperature furnace equipped with the proper controls. This may well run into considerable expense.

Microscopic Studies of Artificial Inorganic Solids

A COMPREHENSIVE VOLUME, "The Microscopic Characters of Artificial Inorganic Solid Substances or Artificial Minerals," by Alexander Newton Winchell, professor of mineralogy and petrology, University of Wisconsin, has been published by John Wiley and Sons, Inc., New York.

The microscopic character of artificial minerals is thoroughly covered and the volume should be valuable to cement or ceramic engineers interested in the microscopic study of portland cements or similar artificial mineral compounds.

Does Standard Testing Specification Indicate True Strength of Portland Cement?

By Katsuzo Koyanagi
Chichibu Cement Co., Ltd., Tokyo, Japan

IN AN ARTICLE comparing the fineness of two series of cements ground by different methods, the writer has shown how unreliable the standard sieve method of fineness determination is.

The writer has one more doubt on the reliability of the present standard specification for testing cement; that is as to whether or not the standard specification for testing cement indicates the true strength quality of portland cement.

The strength of earth-moist mortar with or without hammering is adopted at present as the standard specification for testing cement in almost all countries in the world. But as cement is used mostly in concrete or ferro-concrete, it is beyond question that the concrete strength represents the true strength quality of cement.

The writer has very often found in testing various sorts of portland cement bought up from the market that the cement which shows an extraordinarily high strength when tested by the standard method often gives a low concrete strength, and vice versa. Some examples of this are given in the following table:

From these tests it can be seen that the standard specification for testing cement strength is not always reliable for determining the true strength quality.

That testing with earth-moist mortar is unreasonable and uncertain, and that it would be better to substitute a bending test of a prism made of plastic cement mortar, has been noted for a long time by many authorities, especially in Switzerland. The writer has read lately that the test of plastic mortar is expected to be adopted as standard specification in the near future in Switzerland, but the great difficulty encountered in adopting the Swiss method of plastic mortar testing in other countries is that it is not easy to find the standard sand with fractions of various fineness so indispensable for this test. At any rate, the present standard test of earth-moist mortar is unreliable. The writer waits anxiously for a better method of cement testing, by which the strength quality of cement can be correctly judged.

STRENGTH TESTS OF CEMENTS

	Fineness residue, %		Standard mortar (1:3, water 7–7.3% of the weight of mixed substance)						Concrete (1:2:4, water-cement ratio 0.65)			
	on the sieve of		Tensile strength, kg./cm.²			Compressive strength, kg./cm.²			Slump test,	Compressive strength, kg./cm.²		
Cements	4900/ cm.²	10,000/ cm.²	3 days	7 days	28 days	3 days	7 days	28 days	cm.	3 days	7 days	28 days
A	1.2	5.3	35.8	34.5	41.6	454.6	537.3	722.6	18	46.0	86.0	171.0
B	1.6	7.8	31.5	41.1	43.6	359.3	504.6	688.0	19	35.0	69.5	149.0
C	1.6	5.9	30.8	37.1	41.5	358.0	502.0	657.0	18	23.0	76.5	132.0
D	1.2	5.8	32.3	40.3	45.5	384.0	453.3	618.6	18	45.0	86.0	179.0
E	5.0	13.8	.....	29.1	36.6	426.0	483.0	520.0	19	62.3	135.0	197.3
F	4.8	13.2	.....	33.5	39.6	407.0	461.0	546.0	18	46.2	89.2	180.3
G	3.2	11.2	.....	38.6	39.1	424.0	483.3	567.3	20	38.4	97.4	188.0
H	4.0	12.1	.....	31.0	36.3	390.6	490.3	578.6	18	69.0	140.0	206.0

Calculating Average Grain Diameter from Sieve Analysis

AN INTERESTING METHOD of finding the average grain diameter of the product of a grinding mill or of a natural sand or similar product is described by F. C. Bond in the July issue of the *Engineering and Mining Journal*. It uses Stadler's system of ordinal numbers, which were originally calculated to represent the comparative work to crush rock to any size. Since the theory (Kick's law) on which they were based is now somewhat discredited, these numbers are not so much used as formerly, but it seems they have an important use in other calculations. The table which follows is based on them.

The fourth column was found by the formula:

$$\text{Average grain diameter} = \frac{8052}{(1.414)^n}$$

The numerator is the average grain diameter retained on a 3-mesh sieve and the denominator is the square root of 2 raised to the ordinal number of the sieve in question.

Sieve No.	Mesh	Opening, microns	Average diameter of grains retained, microns
	3	6680	8052
1	4	4699	5694
2	6	3327	4026
3	8	2362	2847
4	10	1666	2013
5	14	1178	**1424**
6	20	833	1006.5
7	28	589	711.7
8	35	417	**503.2**
9	48	295	355.8
10	65	208	251.6
11	100	147	177.9
12	150	104	125.8
13	200	74	88.96
14	270	.....	62.91
15	400	.....	44.48
16	.....	.....	31.45
17	.....	.....	22.25

As the relative size distribution of the half of the sample containing the larger grains and the half containing the smaller grains has been found to be nearly constant, the use of the median rather than the actu l average diameter is suggested, and it is this which the author of the article finds by the following formula:

$$n = n_1 + \frac{50 - \%\text{ cum. on } n_1}{\%\text{ cum. on } n_2 - \%\text{ cum. on } n_1}$$

In this, n_1 is the ordinal number of the finest sieve retaining less than 50% cumulative of the sample and n_2 the ordinal number of the coarsest sieve retaining more than 50% cumulative of the sample $(n_1 + 1)$ and n is the ordinal number of the hypothetical sieve required to divide the sample into two portions of equal weight.

As an illustration, the assumption is made that sieve No. 9 retained 47.1% cumulative and sieve No. 10 55.0%.

$$n = 9 + \frac{50 - 47.1}{55.0 - 47.1} = 9.367$$

$$\text{and the median diam.} = \frac{8052}{(1.414)^{9.367}} = 313 \text{ microns.}$$

Where less than 50% of the sample is retained on 200-mesh the formula must be changed.

Considering first the case where the percentage through 200-mesh is less than 100 minus the per cent. cumulative retained on 150-mesh:

$$n = 13 + \frac{\%\text{ through 200-mesh} - 50}{\%\text{ cum. on 200-mesh} - \%\text{ cum. on 150-mesh}}$$

Where the percentage through 200-mesh is higher than in the case given in the foregoing, but less than 100 minus, the per cent. cumulative retained on 100-mesh:

$$n = 13 + \frac{\%\text{ through 200-mesh} - 50}{\frac{1}{2}(\%\text{ cum. on 200-mesh} - \text{cum. on 100-mesh})}$$

The extrapolation may be carried to any desired point in a similar manner.

British Portland Cement Standards

THE British Engineering Standards Association has issued a revised edition of the British Standard Specification for Portland Cement (B.S.S. No. 12-1931), which was last revised in 1925. The new specification contains a number of modifications, amongst which may be noted the elimination of the 28-day test for cement and sand mortar, the three- and seven-day tests only be specified: the introduction of a new method for ascertaining the quantity of water to be used for gaging for the tensile strength (cement and sand mortar, setting time and soundness tests); the reduction of the time of boiling in the test for soundness from six hours to three hours, and the inclusion of a stipulation as to the weight of cement in bags, wooden casks or steel drums. This last stipulation is not, however, to become operative until January 1, 1933.

The tensile test on neat cement is no longer obligatory but is given in an appendix as an optional test.

Hints and Helps for Superintendents

Driving the Idlers of a Conveyor Belt

By W. E. Warner
Welwyn Garden City, Herts, England

THE BELT of one of our long conveyors was found to crack and tear quickly at the edges, although the head pulley was large. It was thought probable that the tearing was due to the driving power being applied at the one point, the head pulley, and it was therefore decided to try and overcome the difficulty by driving two of the idlers along the length of the belt.

Hence, each of these idlers was driven by a small electric motor connected up so that the peripheral speed of the idler would be the same as the speed of the belt. It was found that the power taken by the main motor was then reduced in proportion to the power taken by the two idler motors showing that they were taking their share of the load and that the stress in the belt was reduced and made more uniform.

The use of these live idlers was very successful, as further slipping or tearing of the belt was prevented and general wear and tear of the belt was reduced.

Protecting Electric Cables

WHERE electric shovels are used in a quarry the cables are constantly in danger of being damaged if left lying on the ground. Frequently they are raised overhead by putting them on wooden poles, but since these are usually immovable they are inconvenient. A simple, movable cable support is illustrated in the accompanying view. The base of the support is an old rim from an auto truck. The upright is a piece of pipe split three ways at the bottom with a welding outfit, with the sections spread out to reach the edge of the rim. They are then welded to the rim. At the top the pipe is split in half and spread apart. Then a piece of old hose is forced over each half to protect the cable and the support is complete.

Truck rim and pipe form cable supports

Feed Arrangement for Crushers

GYRATORY CRUSHERS are so constructed that all repairs, except replacing the top or bottom shell, can be conveniently made without disturbing the floor, which may also serve as part of the hopper.

The jaw crusher, however, is different, especially where the stone is dumped directly into it from trucks or cars. The only part of the crusher not to be protected by a covering is the feed opening itself. When repairs of any consequence are made the parts will have to be taken out from the top, necessitating the removal of any floor or covering.

An installation which is novel and most convenient has all parts of the floor and chute feeding the crusher made in heavy sections and all sections removable. None are bolted or fastened down. By means of an overhead crane any section could be lifted out in a few minutes' time without the aid of crowbars, wedges or other destructive and time-absorbing tools.

The floor extends back to the top of the swing jaw and covers all the crusher and crusher frame except the feed opening. No part of the crusher is exposed to the abrasion of the stone. Right in front of the swing jaw is a vertical wall or baffle intersecting the floor. This is not protected by iron except right over the swing jaw, where there is a manganese plate 2½ in. thick, which has been cast the correct size and shape to fit into the feed opening far enough to protect everything down to the top of the swing jaw plate. Above the feed opening it is wide enough to protect the swing jaw bearings. This wall is about 3 ft. high and had an eye in the top. The wall was set in slots at either end so that by hooking into the eye it could be lifted out.

Supporting End of Chutes

WHEN MATERIAL is to be chuted a considerable distance the chute is usually of heavy construction and rather cumbersome. Changing the chute from one bin to another is generally not an easy job, but it can be made easy if the swinging end of the chute is supported as shown in the illustration, which was taken at the plant of the Francey Stone and Supply Co., Wauwatosa, Wis.

A cable and pulley arrangement facilitates movements of chute

The chutes at this plant are 10-in. pipe pivoted at the upper end and free to swing at the lower end. Cables were strung across the plant above the lower end of each chute and pulley wheels which ran on these cables supported the chutes through other cables. Changing the chute simply required a moderate push or pull on the lower end of the pipe.

The use of pipe for chutes also has another advantage because it is possible to use all sides of the pipe and get good wear out of every portion of the pipe. The pipe is

secured with collars which, when loosened, permit revolving it any desired amount. The pipe used by the Francey company is revolved one-sixth of a complete turn each time, and hence each chute has six complete wearing surfaces before it must be renewed.

Loading Concrete Tile

AT THE Lake View Concrete Tile Co. plant at Lake View, Ia., a considerable stock of fabricated tile, concrete block, etc., is kept in storage to be shipped by truck and in standard gage box cars.

To load the box cars conveniently a narrow gage track system has been installed so

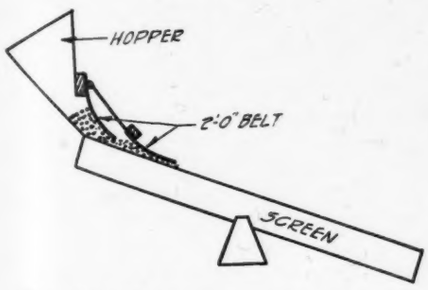
Old motor car, remodeled for locomotive service, delivers cars to loading point

that small flat cars can be loaded and delivered to a point near the loading platform. At this point the cars go up a small incline until they are about level with the box-car floor.

The source of power for this work is from an old Ford motor car, which has been made over into a narrow gage locomotive as shown in the illustration. To increase the amount of traction when pushing the loaded flat car ahead, the rear platform of the remodeled Ford is weighted down with boulders.

Increasing the Efficiency of a Vibrating Screen

SOME vibrating screens in rock crushing and sand and gravel plants let the material roll down and off the screen so quickly that some of the fines are thus carried over instead of falling through. To eliminate this trouble a simple feeding device can be installed, as shown in the accompanying sketch, which slows up the roll of the material and allows sufficient time for the small size pieces to pass through the mesh. A piece of old belt about 2 ft. wide and long enough to cover the width of the screen is attached by one edge to a beam or convenient support above the upper end of the screen. If a hopper is used for feeding the screen the belt can be fastened across the outer edge of this, as shown in the sketch. The belt is fastened about 1 ft. above the screen surface so that normally the lower portion rests against the screen. Material falling against this is slowed up and only passed as more material above forces it on down. However, the arrangement in no way blocks the screen or backs up the material to any extent.



Material falling against belt fastened above screen surface is slowed up

If one piece of belt does not eliminate all the roll of the material down the screen, a second piece the same size as the first can be suspended at a point further down. This can be fastened to a piece of 2x4 material and hung by wires from the beam used for the first piece.

Old Pump Shell Makes Velocity Reducer

THE DREDGES of the Stewart Sand and Material Co. that operate on the Missouri river at Kansas City, Mo., are compactly arranged. Screening and classification of the sand and gravel, as well as the removal of lignite, are accomplished on the boats that are virtually floating classifiers. The sand and gravel is taken from the river bars by a 10-in. Amsco manganese-steel pump that delivers to a hopper serving the primary scalping screen, but the velocity of the water from the pump would be a handicap were not special methods taken to reduce this velocity as the water discharges to the hopper.

To accomplish the purpose a 10-in. pump shell has been inserted in the discharge line in a horizontal position, the intake being what would normally be the shell outlet. The shell being in a horizontal position, as shown in the illustration, its discharge points downward, where the material falls to a small hopper serving the primary screen.

By the use of this device the velocity of the pump discharge is much reduced and it helps to confine the splashing water in a smaller space than would be possible were not some such special provision made.

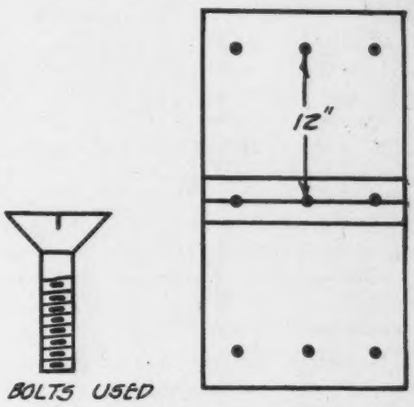
Pump shell in discharge line confines splashing water to smaller space

Improving Grip on Conveyor Pulley

By W. E. Warner
Herts, England

SOMETIMES it is found that when fully loaded a conveyor belt will not properly grip the pulley. This can be remedied by coating the pulley with sheet rubber, the coefficient of friction between rubber and the belt being much greater than between the metal pulley and the belt.

Sheet rubber should be used as wide as the pulleys and sufficiently long to completely encircle them. The sheeting can be secured to the pulley by means of



Showing location of holes for bolting down spliced sheeting

bolts. A series of ½-in. clearance holes should be drilled in the pulley. These should be placed three in a line, one at each end and one in the middle.

These holes should be drilled round the pulley at a distance of 12 in. Screws as illustrated should be used, the nuts being placed on the inside of the pulley.

Where the sheeting meets the two ends should be chamfered and a spliced joint made. The two ends should be cemented together by rubber cement and then bolted down. The joint being made directly over drilled holes in the pulley.

Rock Products Clinic

Gypsum Paper Filler

THE EDITOR: We have just received our copy of ROCK PRODUCTS for January 9, and I have read with a good deal of interest your article on page 104 dealing with the gypsum industry. You give figures showing the heavy decline in tonnage during 1931 as compared to 1930, and mention the way in which members of the industry are endeavoring to meet the situation by research work looking toward the production of new materials from gypsum, or the opening of new fields for certain products.

We do not challenge your statement that the United States Gypsum Co. is probably the leader in this work, We believe it to be entirely true. However, when you devote 25% of the entire article to a discussion of the possibilities of the paper filler trade, I think some mention might have been made of the fact that the Best Bros. Keene's Cement Co. was the pioneer in this business, and has been doing a steady and considerable tonnage in it for 18 years before our competitor took it up.

We admit that our own business was largely in the dead-burned product. We have shipped during the past 20 years a number of carloads of raw ground gypsum, but feel that the possibilities you mention of tonnage in this field have still to be established. Raw ground gypsum is competing almost entirely with domestic clay, which is worth today only about $5 per ton at the mine. There are probably not more than two or three deposits of gypsum in the United States of sufficient purity of color to be used in paper manufacture; the gypsum has to be ground approximately 300-mesh fine, and anyone who has tried grinding raw gypsum to such a fineness and on such a low price limit realizes the problem he is up against; and there are technical points in regard to the use of the material in paper that we would hardly consider as having been fully solved.

The Best Bros. Keene's Cement Co. pioneered the use of gypsum products in a number of specialty fields. We doubt if there is a concern in the industry that spends any more on research work, proportionate to its size, than we do. We not only have our mill testing laboratory, but a straight research laboratory including some pieces of equipment that probably are not duplicated in more than half a dozen laboratories in the country. In addition to our permanent chemists we are spending today, at a time when economy is as necessary to us as to any other company, fully $1000 per month on work done by outside or independent chemists, whom we have retained to work on certain definite problems.

This letter is not intended to detract from the volume and character of the research work that has been done on gypsum by one of our competitors. The excellence of it no doubt has had something to do with the exceptional earnings that this competitor has been able to show for a number of years past. We also would not write this letter if the article in question had been furnished to you by them, as it is not our intention to get into an argument with any of our friends or competitors through your columns. As the article is unsigned, however, we presume it was written by some member of your staff or other contributor. [By a member of our staff.—EDITOR.]

We do feel however, that an article which mentions the use of gypsum in the paper industry, either as a new line or the revival of an old one, might have added the fact that we have furnished this trade for the past 20 years on (for us) a considerable scale.

Might we add that it is one of the most exacting lines of trade that we are engaged in and calls for very close supervision in the process of manufacture. There are certain classes of paper that would be spoiled unless the calcium carbonate content of the gypsum was held very low, generally less than 1%, while the material not only has to be of excellent color in a general sense, but every possible trace of dirt or any other foreign substance has to be eliminated.

JOHN C. BEST,
President, Best Bros. Keene's Cement Co.

On Unbreakable Glass

THE EDITOR: I was interested in a short article appearing in your issue of December 19, 1931, under the heading of "Makes Unbreakable Glass from Nebraska Sand," taken from the *Omaha* (Neb.) *World-Herald*, in which a Nebraskan noticed in a German beer garden that a thin beer glass falling upon the floor did not break, and later upon inquiry he found that this glass was made from imported Nebraska sand. Finally, the correspondent asked why American glass manufacturers could not do the same thing.

In answer I may state that I doubt that an unbreakable glass can be made. This particular instance was very likely an accident which often happens, as glasses frequently fall without breaking. In fact, by special heat treatment, and also due to certain characteristics of shape, many ordinary glass containers will not break readily upon falling, and there are many such articles made in this country. Furthermore, by developing glasses of special composition the resistance to shock is very greatly increased.

In the last 25 years the glass industry of America and the whole world has been greatly developed on a basis of scientific control, and today the physical and chemical characteristics of glass are developed on a basis of a definite knowledge of the fundamental ingredients of a glass batch in relation to the final product.

HENRY W. HESS,
Consulting Chemical Engineer,
Arnold and Weigel, Inc.

Another Suggestion

THE EDITOR: This has no bearing on production data and you have probably been asked this before, but as an interested and regular reader of ROCK PRODUCTS in preference to any other magazine of similar nature, I have often wondered why you do not print a page devoted to good jokes and other humorous incidents that take place around every business in the country.

There are many serious-minded business men in our country who feel that they must always have a hard-boiled look on their faces in order to impress their employes and especially competitors and salesmen, but even those so-called hard-boiled eggs will give vent to a huge roaring laugh at some joke or incident, especially one that has to do with a business in which they themselves are deeply interested.

I am sure that many of your subscribers would be glad to send jokes and funny incidents that may take place around the plant. I would be glad to help in all possible ways myself, and so you might give the idea a thought; for, after all, what is there in life that is more worth-while than a good hearty laugh? "A PACIFIC COASTER."

Editor's Note

Our correspondent, who incidentally is superintendent of a sand and gravel plant, is entirely right about most of us taking ourselves entirely too seriously for our own enjoyment of life, as well as that of our contemporaries. Incidentally, that's the chief reason why some of us, perhaps, do not believe in the soundness or logic of the prohibition law. For however one may personally think about the use of alcoholic beverages, or one's personal tastes or limitations in regard to its use, his own experience in the world as well as the history of the ages proves it has always been a means of separating mankind from too serious a contemplation of himself.

The trouble about establishing a "joke page" in ROCK PRODUCTS is that really good jokes are mighty scarce, and these usually appear more or less simultaneously.

If our readers would themselves furnish us with good stories relevant to their own experience, as the correspondent suggests, we would indeed be glad to have them and to publish them. So, while we will not promise a "funny page" as a regular feature, we will be only too glad to help our readers get a little enjoyment from our pages once in a while, in addition to the information they now get regularly.—The Editors.

Editorial Comment

Cost Saving in Government Bureaus

We watch with interest, and like other business institutions we are in favor of economies in government. We believe there are numerous government bureaus and activities that are wasteful and indeed useless. On the other hand there are government bureaus that more than earn their maintenance costs to business and industry. We believe the Bureau of Mines and the Bureau of Standards, of the U. S. Department of Commerce, are two of these. We hope that in the process of separating the sheep from the goats discrimination rather than politics will rule.

Aggregate Specifications and Aggregate Plants

In the past ten years aggregate plants have constantly grown more complex in design and more expensive to construct. A few years ago a crushed stone or a gravel plant costing half a million was a rarity. Today there are many plants that cost more, and plant designs or flow sheets instead of becoming simpler tend to become more complex.

A part of the increase in size and first cost is due to increased number of uses for aggregates and the necessity for supplying large quantities of various kinds of material on comparatively short notice. But more of it has come from the varied demands of aggregate users. For years specifications have been growing more and more exacting and at the same time they have become more and more varied.

It is the pride of the aggregate industry that as developments in concrete practice made new and more exacting demands for material it was alive to and able to fill this demand. But it has cost money in plant construction and operation. Perhaps a third to a half of the first cost and a good portion of the operating cost of a really modern plant must be charged to building and operating it so that it can fill specifications as a druggist fills prescriptions. Batch deliveries and ready mixed concrete plants as adjuncts have added another factor of complexity.

It is a fair question if this development of the business has not been carried too far. For one thing it has sometimes led to the building of larger plants than the normal market demanded. It does not pay to build elaborate arrangements for storing, recrushing, mixing and blending and preventing segregation on a small scale. So long as the demand for aggregates was constantly increasing the owners of too large a plant might think that the business would grow to it. But when the demand fell its disadvantages were fully apparent. Running a 5000-ton plant to supply a 2000-ton market has proved expensive in more cases than one.

Too many aggregate specifications has been responsible for complexity in plant design. Sometimes there has been an absurd confusion, as where city, state and county, and numerous private users each demanded a certain grading; and what would fill one specification would not fill the others. But this condition is passing as local engineering bodies get together with producers and agree on a few standard sizes and gradings. A more serious difficulty comes from the fact that aggregate specifications have taken two distinct trends. One calls for separate sizes, the other for a graded aggregate. To judge from recent work of the United States Bureau of Public Roads, separate sizes are preferred, and the highway departments of several states call for them. But the Federal specifications adopted in 1930 call merely for a reasonably uniform grading and a practically constant fineness modulus. Many if not most engineers and contractors who do general construction want this. A plant to make material to fit both sorts of specifications must include the usual sizing and cleaning, storage for separate products, blending and mixing arrangements and perhaps methods for recrushing products that have been stored. A plant that had only to fill one type of specification could be much simpler.

The important thing to understand is that all aggregate specifications have a single purpose, that of insuring aggregates of reasonable uniformity in maximum size and grading, when they go into the mixer; cleanliness and freedom from deleterious materials being assumed. Differences in specifications reflect only differences in opinion as to how this end may best be achieved. So far the producers, who are the ones most affected, have not had much to say. They have preferred to let the engineers and research men work out methods and tell them what was wanted. But it may be the time now for producers to give more attention to this phase of aggregate specifications than they have in the past. Conditions call for the lowest possible costs. Plants as they wear out must be replaced. And the big, complex plants are expensive to build and to operate. The public has to pay the extra cost, and sometimes, after weighing the various items of delivered costs turns to the wayside pit, in spite of its less desirable product. If the producers, bearing in mind that all reasonable engineers want is a fair degree of uniformity in the product, would look for the shortest and simplest way to attain this, and would sell this idea to the engineers, the aggregate industry, the users of aggregate and the public might all be benefitted.

Financial News and Comment

RECENT QUOTATIONS ON SECURITIES IN ROCK PRODUCTS CORPORATIONS

Stock	Date	Bid	Asked	Dividend
Allentown P. C. 1st 6's[27]	2-10-32	94	.....	
Alpha P. C. new com.[2]	2- 8-32	8	9	25c qu. Jan. 25
Alpha P. C. pfd.[2]	2- 8-32	80	90	1.75 qu. Dec.15,'31
Amalgamated Phosphate Co. 6's, 1936[19]	2- 6-32	88	.....	
American Aggregates com.[27]	2-10-32	3	4	
American Aggregates pfd.[19]	2- 6-32	5	.....	1.75 qu. Jan. 1
Amer. Aggr. 6's, w.w.[19]	2- 6-32	35	45	
Amer. Aggr. 6's, ex-w.[19]	2- 6-32	33	42	
Amer. L. & S. 1st 7's[27]	2-10-32	71	75	
American Silica Corp. 6½'s[30]	2-10-32	No market		
Arundel Corp. new com.	2- 9-32	26 actual sale		75c qu. Jan. 2
Bessemer L. & C. Class A	2- 9-32	.....	10	
Bessemer L. & C. 1st 6½'s[4]	2- 5-32	25	35	
Bloomington Limestone 6's[27]	2-10-32	.....	25	
Boston S. & G. new com.[37]	2- 5-32	4	7	15c qu. Jan. 2
Boston S. & G. new 7% pfd.[37]	2- 5-32	30	35	87½c qu. Jan. 2
California Art Tile, A	2- 2-32	1½	5¼	
California Art Tile, B[40]	2- 4-32	.....	3	
Calaveras Cement com.	2- 1-32	1½	4	
Calaveras Cement 7% pfd.	2- 1-32	.....	60	1.75 qu. Jan. 15
Canada Cement com.	2- 9-32	6	6¼	
Canada Cement pfd.	2- 9-32	64¾	66	1.62½ qu. Dec. 31
Canada Cement 5½'s[42]	2- 6-32	88	91	
Canada Crushed Stone bonds[43]	2- 6-32	70	80	
Canada Crushed Stone com.[42]	2- 6-32	No market		
Certainteed Products com.	2- 9-32	2¾	3	
Certainteed Products pfd.	2- 9-32	11	15½	1.75 qu. Jan. 1
Cleveland Quarries	2- 9-32	.....	54	25c qu. Mar. 1
Consol. Cement 1st 6½'s, A[44]	2-10-32	5	10	
Consol. Cement notes, 1941[27]	2-10-32	No market		
Consol. Cement pfd.[27]	2-10-32	.....	50	
Consolidated Oka Sand and Gravel (Canada) 6½'s[13]	2- 8-32	90	95	
Consolidated Oka Sand and Gravel (Canada) pfd.[41]	1-26-32	51	.....	1.75 qu. Oct.10,'31
Consol. Rock Prod. com.[9]	2- 5-32	25c	35c	
Consol. Rock Prod. pfd.[9]	2- 5-32	2	2½	
Consol. Rock Prod. units[35]	2- 4-32	1¾	3	
Consol. S & G. pfd. (Can.)	2- 9-32	.....	50	1.75 qu. Feb. 15
Construction Mat. com.	2- 9-32	75c	2	
Construction Mat. pfd.	2- 9-32	4	8	
Consumers Rock and Gravel, 1st Mtg. 6's, 1948[38]	2- 4-32	38	42	
Coosa P. C. 1st 6's[23]	2- 5-32	30	40	
Coplay Cem. Mfg. 1st 6's[19]	2- 6-32	40	60	
Coplay Cem. Mfg. com.[33]	2- 5-32	5	7½	
Coplay Cem. Mfg. pfd.[33]	2- 5-32	25	40	
Dewey P. C. com.[47]	2-10-32	95	110	
Dolese and Shepard	2- 9-32	18½	20½	$1 qu. Jan. 1
Dufferin Pav. & Cr. Stone pfd.	2- 9-32	.....	50	1.75 qu. Jan. 2
Dufferin Pav. & Cr. Stone com.	2- 9-32	.....	5	
Edison P. C. com.[32]	2- 5-32	1½	.....	
Edison P. C. pfd.[32]	2- 5-32	5	.....	
Federal P. C. 6½'s, 1941[19]	2- 6-32	72	.....	
Giant P. C. com.[2]	2- 8-32	1½	3½	
Giant P. C. pfd.[2]	2- 8-32	7	11	1.75 s.-a. Dec. 15
Gyp. Lime & Alabastine, Ltd.	2- 9-32	.....	5	10c qu. Oct.5,'31
Gyp. Lime & Alabastine 5½'s[42]	2- 6-32	55	65	
Hermitage Cement com.[11]	2- 6-32	5	10	
Hermitage Cement pfd.[11]	2- 6-32	35	40	
Ideal Cement, new com.	2- 9-32	19	22	50c qu. Jan. 2 & 25c ex.Dec.22,'31
Ideal Cement 5's, 1943	2- 6-32	90	95	
Indiana Limestone units[27]	2-10-32	No market		
Indiana Limestone 6's	2- 5-32	17⅜	18½	
International Cem. com.	2- 9-32	15⅛	15⅞	75c qu. Dec.31,'31
International Cem. bonds, 5's	2- 9-32	63 actual sale		Semi-ann. int.
Iron City Sand & Gravel 6's, 1940[26]	1-21-32	.....	70	
Kelley Is. L. & T. new stock	2- 9-32	13¾	15	25c qu. Jan. 1
Ky. Cons. Stone com.	2- 8-32	.....	2	
Ky. Cons. Stone pfd.	2- 8-32	.....	50	1.75 qu.
Ky. Cons. St. 1st Mtg. 6½'s[45]	2- 8-32	30	40	
Ky. Cons. St. V. T. C.[45]	2- 8-32	1	2	
Ky. Rock Asphalt com.	2- 8-32	3½	4¼	
Ky. Rock Asphalt pfd.	2- 8-32	25	30	1.75 qu. Dec.1,'31
Ky. Rock Asphalt 6½'s	2- 8-32	80	85	
Lawrence P. C.[2]	2- 8-32	12	16	
Lawrence P. C. 5½'s, 1942[2]	2- 8-32	41	44	
Lehigh P. C. com.	2- 9-32	6	7	
Lehigh P. C. pfd.	2- 9-32	70	75	1.75 qu. Jan. 2
Louisville Cement[45]	2- 8-32	175	225	
Lyman-Richey 1st 6's, 1932[13]	2- 5-32	95	.....	
Lyman-Richey 1st 6's, 1935[13]	2- 5-32	90	.....	
MarbleheadLime 6's[14]	2- 5-32	75	80	
Marbelite Corp. com.[35] (cement products)	2- 4-32	.....	75c	
Marbelite Corp. pfd.[35]	2- 4-32	1	.....	
Marquette Cem. Mfg. 1st 5's, 1936[46]	2-10-32	90	.....	
Marquette Cem. Mfg. 1st 6's, 1936[46]	2-10-32	95	.....	
Material Service Corp.	2- 9-32	12½	13¼	
McCrady-Rodgers 7% pfd.[22]	2- 5-32	36	40	87½c qu. Dec. 30,
McCrady-Rodgers com.[22]	2- 5-32	5	10	75c qu. Jan. 26
Medusa P. C. pfd.[47]	2-10-32	50	60	
Medusa P. C. com.[47]	2-10-32	9½	12	
Monarch Cement com.[47]	2-10-32	65	70	
Michigan L. & C. com.[9]	2- 6-32	45	.....	
Missouri P. C.	2- 9-32	15	16	25c qu. Jan. 30
Monolith Portland Midwest com.[9]	2- 5-32	75c	1	
Monolith P. C. com.[9]	2- 5-32	1½	2	40c s.-a. Jan. 1
Monolith P. C. pfd.[9]	2- 5-32	3½	4	40c s.-a. Jan. 1
Monolith P. C. units[9]	2- 5-32	8½	10	
Monolith P. C. 1st Mtg. 6's[9]	2- 5-32	65	70	
National Cem. (Can.) 1st 7's[27]	2-10-32	90	95	
National Gypsum A com.[27]	2-10-32	2	2¼	
National Gypsum pfd.[27]	2-10-32	30	35	1.75 qu. Jan. 2
National Gypsum 6's[3]	2-11-32	50	.....	
Newaygo P. C. 1st 6½'s[27]	2-10-32	79	.....	
New England Lime 6's, 1935[14]	2- 5-32	50	75	
N. Y. Trap Rock 1st 6's	2- 9-32	66⅛ actual sale		
N. Y. Trap Rock 7% pfd.[30]	2- 5-32	52	.....	1.75 qu. Jan. 2
North Amer. Cem. 1st 6½'s	2- 9-32	17½ actual sale		
North Amer. Cem. com.[27]	2-10-32	50c	1	
North Amer. Cem. 7% pfd.[27]	2-10-32	1	4	
North Shore Mat. 1st 5's[15]	2-10-32	No market		
Northwestern States P. C.[31]	2- 9-32	.....	76	
Ohio River S. & G. com.	2- 8-32	.....	8	
Ohio River S. & G. 7% pfd.	2- 8-32	.....	98	
Ohio River S. & G. 6's[16]	2- 5-32	50	70	
Oregon P. C. com.[9]	2- 5-32	8	12	
Oregon P. C. pfd.[9]	2- 5-32	80	85	
Pacific Coast Aggr. com.[40]	2- 4-32	.....	25c	
Pacific Coast Aggr. pfd.[40]	2- 4-32	.....	50c	
Pacific Coast Cement 6's[5]	2- 4-32	80	.....	
Pacific P. C. com.	2- 2-32	.....	8	
Pacific P. C. pfd.	2- 2-32	.....	50	1.62½ qu. Jan. 5
Pacific P. C. 6's[9]	2- 4-32	90	94	
Peerless Cement com.[1]	2- 5-32	25c	75c	
Peerless Cement pfd.[1]	2- 5-32	10	15	
Penn.-Dixie Cement com.	2- 9-32	⅞	1	
Penn.-Dixie Cement pfd.	2- 9-32	3	4	
Penn.-Dixie Cement 6's	2- 9-32	42	42⅛	
Penn. Glass Sand Corp. pfd.	2- 3-32	65	75	
Penn. Glass Sand Corp. 6's	2- 3-32	85	90	
Petoskey P. C.	2- 9-32	2½	3	
Port Stockton Cem. com.[9]	2- 5-32	No market		
Riverside Cement com.[9]	2- 5-32	.....	12	
Riverside Cement pfd.[9]	2- 5-32	55	60	1.50 qu. Feb. 1
Riverside Cement, A	2- 2-32	.....	7	
Riverside Cement, B[9]	2- 5-32	70c	1	
Roquemore Gravel 6½'s,[17]	2- 6-32	98	100	
Sandusky Cement 6½'s, 1931-37[19]	2- 6-32	80	100	
Santa Cruz P. C. com.	2- 2-32	.....	75	$1 qu. Jan. 1 & $2 ex. Dec.24,'31
Schumacher Wallboard com.	2- 2-32	1½	.....	
Schumacher Wallboard pfd.	2- 2-32	.....	12	50c qu. Feb. 15
Southwestern P. C. pfd.[35]	2- 4-32	70	.....	
Southwestern P. C. units[35]	2- 4-32	175	225	
Standard Paving & Mat. (Canada) com.	2- 9-32	2¼	2¾	
Standard Paving & Mat. pfd.	2- 9-32	.....	53	1.75 qu. Feb. 15
Superior P. C., A	2- 2-32	.....	26¾	27½c mo. Mar. 1
Superior P. C., B	2- 2-32	5¼	8	25c Dec.21,'31
Trinity P. C. units[31]	2- 9-32	77	.....	
Trinity P. C. com.[31]	2- 9-32	12	20	
U. S. Gypsum com.	2- 9-32	19½	20	40c qu. Dec.31,'31
U. S. Gypsum pfd.	2- 9-32	103½	116¼	1.75 qu. Dec.31,'31
Wabash P. C.[21]	2- 5-32	.....	17	
Warner Co. com.[16]	2- 5-32	4¼	5¼	25c qu. Oct.15,'31
Warner Co. 1st 7% pfd.[16]	2- 5-32	60	75	1.75 qu. Jan. 1
Warner Co. 6's, 1944, with war.	2- 5-32	.....	70	
Warner Co. 6's, 1944 no war.	2- 5-32	.....	66	
Whitehall Cem. Mfg. com.[30]	2- 5-32	.....	90	
Whitehall Cem. Mfg. pfd.[30]	2- 5-32	.....	50	
Wisconsin L. & C. 1st 6's[15]	2-10-32	No market		
Wolverine P. C. com.	2- 9-32	1⅛	3¼	15c qu. Nov.15,'31
Yosemite P. C. A com.[9]	2- 5-32	1	1½	

Quotations by: [1]Watling Lerchen & Hayes Co., Detroit, Mich. [2]Bristol & Willett, New York. [3]Rogers, Tracy Co., Chicago. [4]Butler, Beadling & Co., Youngstown, Ohio. [5]Smith, Camp & Riley, San Francisco, Calif. [6]Frederick H. Hatch & Co., New York. [7]J. J. B. Hilliard & Son, Louisville, Ky. [8]Dillon, Read & Co., Chicago, Ill. [9]A. E. White Co., San Francisco, Calif. [10]Lee Higginson & Co., Boston and Chicago. [11]J. W. Jakes & Co., Nashville, Tenn. [12]James Richardson & Sons, Ltd., Winnipeg, Man. [13]Stern Bros. & Co., Kansas City, Mo. [14]First Wisconsin Co., Milwaukee, Wis. [15]Central-Republic Bank & Trust Co., Chicago. [16]J. S. Wilson, Jr., Baltimore, Md. [17]Citizens Southern Co., Savannah, Ga. [18]Dean, Witter & Co., Los Angeles, Calif. [19]Hewitt, Ladin & Co., New York. [20]Tucker, Hunter, Dulin & Co., San Francisco, Calif. [21]Baker, Simonds & Co., Inc., Detroit, Mich. [22]Peoples-Pittsburgh Trust Co., Pittsburgh, Penn. [23]Howard R. Taylor & Co., Baltimore. [24]Richards & Co., Philadelphia, Penn. [25]Hincks Bros. & Co., Bridgeport, Conn. [26]Bank of Republic, Chicago, Ill. [27]National City Co., Chicago, Ill. [28]Chicago Trust Co., Chicago, Ill. [29]Boettcher-Newton & Co., Denver. [30]Hanson and Hanson, New York. [31]S. F. Holzinger & Co., Milwaukee, Wis. [32]Tobey and Kirk, New York. [33]Steiner, Rouse and Co., New York. [34]Jones, Heward & Co., Montreal, Que. [35]Tenney, Williams & Co., Los Angeles, Calif. [36]Stein Bros. & Boyce, Baltimore, Md. [37]Wise, Hobbs & Arnold, Boston. [38]E. W. Hays & Co., Louisville, Ky. [39]Blythe Witter & Co., Chicago, Ill. [40]Martin Judge Co., San Francisco, Calif. [41]A. J. Pattison Jr. & Co. Ltd., Toronto, Canada. [42]Nesbitt, Thomson & Co., Toronto. [44]E. H. Rollins, Chicago. [45]Dunlap, Wakefield & Co., Louisville, Ky. [46]First Union Trust & Savings Bank, Chicago. [47]Anderson Plotz and Co., Chicago, Ill.

Annual Report of the Warner Company

THE YEAR 1931 presented a continuous drop in business activity in practically all lines of endeavor. The Warner Co.'s volume of business and market prices, according to the annual report of its president, Charles Warner, experienced the same general trend. All classes of expenses were kept as closely in line as possible with the steady decline in plant operations, sales volume, and prices. Where salaries and wage rates were involved, the officers used their best efforts to effect the necessary economies, with the least amount of hardship to old and loyal employes. The major part of the economies was not accomplished until October 1, and hence did not benefit the company to any large extent on the year's expenses. The year 1932 will gain the full benefit, with such further retrenchments as may be necessary if further decline in volume is experienced.

In spite of the progress made during the year in increasing the volume of sales in the new "Central-Mix" concrete product, the gross sales of the company dropped 27.7% in 1931 from the preceding year. The earnings statement shows a net result for the year equivalent to 2.2 times all interest charges, and a net return of 2.5 times the dividend requirements on the first preferred stock. This result, while satisfactory under the condition of heavy decrease in gross volume of business and price recessions, was not quite sufficient to cover the regular dividends on the second preferred stock, and explains the reason for the conservative action of the directors in discontinuing common stock dividends during the final quarter of the year.

During the year the company further decreased its underlying obligations by $704,000, subject to the issuance of 1500 shares first preferred stock in connection with the formation of an employes' stock purchase plan known as Warner Organization Securities Co.

In spite of extensive price recessions, the ratio of total costs to sales has remained practically the same throughout the last two and one-half years. This indicates a satisfactory control of costs and, further, that normal earnings should resume with a moderate improvement in business volume.

The company has enlarged its territory for Central-Mix concrete by completing its Morrisville plant for serving the Trenton market. Because of the advantages of this product on both engineering and economic grounds, yardage delivered in 1931 increased substantially over 1930, and the product now

CONSOLIDATED BALANCE SHEET OF THE WARNER CO. (AS OF DECEMBER 31, 1931)

ASSETS

Current assets:			
Cash			$246,991.77
Accounts receivable		$1,028,253.54	
Notes receivable	$252,996.61		
Less notes discounted	195,000.00	57,996.61	
		$1,086,250.15	
Less reserve for doubtful accounts		42,233.16	1,044,016.99
Inventories (lower of cost or market)			710,488.95
Total currents assets			$2,001,497.71
Investments in controlled and other companies:			
Controlled:			
American Lime & Stone Co.	(a)	$440,486.00	
Blue Diamond Co. of Philadelphia	(b)	79,918.77	
King Farms Co.	(c)	71,000.00	
Other		443,874.82	
Total investments			1,035,279.59
Fire insurance and workmen's compensation funds			190,371.28
Property, including land, mineral deposits, buildings, equipment, etc.		$23,224,427.63	
Less reserves:			
Depletion	$ 832,295.20		
Depreciation	6,712,114.54	7,544,409.74	
Property (net value)			15,680,017.89
Deferred charges:			
Prepaid insurance, licenses, rentals, etc.		$100,615.68	
Bond discount and expense (unamortized)		465,236.80	
Development, repairs and miscellaneous		85,026.78	
Total deferred charges			650,879.26
TOTAL ASSETS			$19,558,045.73

(a) Book value 3,500 shares preferred stock.... $483,000.00
10,000 shares common stock.... 558,545.16
Total $1,041,545.16

(b) Book value—none.
(c) Book value—$71,000.00.

LIABILITIES

Current liabilities:			
Accounts payable			$102,616.06
Dividends payable (preferred) due Jan. 2, 1932			144,376.75
Accrued interest and ground rents			102,610.40
Accrued federal income tax			17,699.38
Other accruals			21,216.07
Total current liabilities			388,518.66
First mortgage 6% sinking fund bonds (authorized and issued $7,000,000.00; redeemed $995,000.00) outstanding		$6,005,000.00	
Less treasury		68,000.00	5,937,000.00
Mortgage (Burlington Island)			45,000.00
Ground rents (principal)			365,000.00
Leasehold purchase contract			286,000.00
Purchase money obligations:			
Arsenal mineral deposits		205,500.00	
Capital stock (George A. Sinn, Inc.)		251,099.95	456,599.95
Reserve for fire insurance, workmen's compensation and miscellaneous			194,498.61
First preferred capital stock (authorized 50,000 shares: issued 33,000 shares; reacquired and cancelled 3,867 shares) outstanding 29,133 shares		2,913,300.00	
Less in treasury 1,137 shares		113,700.00	2,799,600.00
Second preferred capital stock (authorized and issued 57,500 shares; reacquired and cancelled 4,000 shares) outstanding 53,500 shares			5,350,000.00
Common capital stock of no par value (authorized 350,000 shares, issued and outstanding 234,657 shares)		3,223,708.70	
Less in treasury 415 shares		9,425.48	
		3,214,283.22	
Acquired surplus		386,635.73	
Earned surplus		134,909.56	3,735,828.51
TOTAL LIABILITIES			$19,558,045.73

ANALYSIS OF SURPLUS

January 1 to December 31, 1931

Allocation by board of directors as per pro-forma balance sheet as adjusted January 1, 1931		$477,811.20
Less:		
Provision for uncollectible accounts incurred prior to April 6, 1929, in excess of amount provided at that date	$86,245.47	
Sundry adjustments (net) applicable to prior to April 6, 1929	4,930.00	91,175.47
Surplus at date of acquisition, April 6, 1929 (adjusted)		$386,635.73
Earned surplus, January 1, 1931	$454,714.32	
Net income, January 1 to December 31, 1931, per consolidated statement of income and profit and loss	490,102.24	
		944,816.56
		$1,331,452.29
Dividends:		
First preferred stock	193,753.00	
Second preferred stock	381,500.00	
Common stock	234,654.00	809,907.00
Surplus, December 31, 1931:		
Surplus at date of acquisition, April 6, 1929 (adjusted)	386,635.73	
Earned surplus	134,909.56	
		$521,545.29

CONSOLIDATED STATEMENT OF INCOME AND PROFIT AND LOSS

January 1 to December 31, 1931

Sales			$9,021,101.24
Less: Costs		$6,285,423.45	
Depreciation and depletion		1,018,258.10	7,303,681.55
			1,717,419.69
Wholesale sales expense		$240,229.36	
Administrative expense		275,130.45	
Provision for uncollectible accounts		69,569.00	
Discount allowed		324,380.81	909,309.62
Net profit			808,110.07
Interest and dividends received		45,737.29	
Discount earned		107,877.52	153,614.81
Gross income			961,724.88
Bond and other interest paid		434,109.51	
Amortization of bond discount and expense		38,643.86	472,753.37
Operating income			488,971.51
Adjustments:			
Gain on purchase of bonds for redemption		29,300.40	
Less unamortized bond discount and expense applicable to bonds cancelled		19,530.53	
		9,769.87	
Gain on purchase of first preferred stock for redemption		9,544.20	
		19,314.07	
Less sundry adjustments		483.96	
Total adjustments		18,830.11	
Provision for federal income tax		17,699.38	1,130.73
Net income			$490,102.24

occupies a preferred position for practically all classes of concrete work in the Wilmington, Philadelphia and Trenton markets.

Safety work for 1931 showed gratifying results compared with 1930, since lost-time accidents and lost-time days decreased about 50%, with no fatalities during the year. This resulted in substantial savings in compensation costs, but of far greater importance was the reduction accomplished in deaths and injuries.

General studies of the construction industry indicate that the surpluses developed by over-construction in the years 1925 to 1929, inclusive, have been largely balanced by the subnormal construction of the past two years. Subnormal construction will probably continue throughout most of 1932 and should develop a shortage in many classes of work by the end of the year. This trend is not yet obvious, due to the extensive doubling up in the use of all types of buildings temporarily enforced on both individuals and business institutions by the necessity for economies.

The company appears to be going through this extremely subnormal period safely, maintaining a strong quick asset position and should come out of the depression in satisfactory physical and financial condition with many new and permanent economies established to the future benefit of stockholders.

Annual Report of Superior Portland Cement, Inc.

THE year 1931 completed the 23rd year of operation of the factory at Concrete, Wash., and the 16th year of continuous dividend payments. The figures for 1931 include the first six months operation of the leased plant of the Pacific Coast Cement Co. in Seattle.

Total current assets at the end of 1931 were $1,219,695, compared to $1,216,500 at the end of 1930. Total current liabilities at the end of 1931 were $183,331, compared to $144,562 at the end of 1930.

The increase in the item of deferred assets (work in process) amounts to $153,177. This is due to carrying at each plant duplicate stocks of rock, slurry and clinker. There is an increase in the item of inventories of $64,513, due to duplicate inventories of cement, gypsum, coal, spare parts, etc.

The total of inventories and deferred assets is increased $217,690 over last year. The total of cash and investments is $217,668 less than last year. In other words, inventories were increased and cash position decreased almost the same figure, due to having two plants to operate.

The ratio of current assets to current liabilities is 6.6 to 1, compared to 8.4 to 1 a year ago.

In conformity with a consistent policy of charging off depreciation and depletion, the plant and real estate account was written down $247,693.

During 1931 the company paid the regular dividend of $3.30 a share on Class A stock, while 50 c. a share was distributed to the Class B stock. There was retired during the year 905 shares of Class A stock, leaving the present amount outstanding 75,240 shares.

On July 1, 1931, the Superior company entered into a lease with the Pacific Coast Cement Co. whereby it took over the operation, for a term of years, of its Seattle cement plant, and the limerock quarries at Dall Island, Alaska. It is anticipated that this lease will be of material benefit to the Superior company, through economies effected by the consolidation of manufacturing and sales activities.

It is the intention of the company to operate both the Concrete and Seattle plants. Cement made at Concrete is being marketed under the "Superior" brand, and that made at Seattle under the "Diamond" brand. "Hyurly" cement is made at Concrete. This is a quick-strength cement, which is meeting the demand in this territory for a cement that can be used to produce high-early-strength concrete.

During 1931 "Superior" portland cement was used on many of the outstanding contracts in this section. Among others were the city of Seattle Skagit power project; Puget Sound Power and Light Co. Rock Island dam; U. S. Reclamation Service, Kittitas project; U. S. Navy at Bremerton; Ford Motor Co. new assembly plant, Seattle, and many paving projects in Washington.

Since leasing the Diamond plant that brand has been supplied on the West Seattle reservoir and the new Federal building in Seattle.

The consumption of Hyurly cement increased at a gratifying rate through the year. The largest local contract on which Hyurly was used was the repaving of Broadway in Seattle.

Up to a few years ago practically all the cement produced by Superior was shipped in cotton bags. A considerable quantity is now being shipped in bulk, and the use of Washington-made paper bags as a container is increasing rapidly.

Sales for the year 1931 show that the company maintained its position in a highly competitive market. Government statistics show that the consumption of cement in this section decreased approximately 26% during 1931, compared to 1930. The company's shipments suffered in like proportion. Present indications are that the volume in 1932 will be less than in 1931.

A decrease in volume of shipments is naturally accompanied by a reduction in profits, because of the influence of fixed expenses which must go on, regardless of operating conditions. The company has endeavored to meet this situation by reducing every possible item of expense. Only through the operation of this policy was it able to report such a favorable position at this time.

For many years the company has been endeavoring to operate a full calendar year at Concrete with a perfect safety record. In two years it has just missed this mark by one or two accidents. In 1931 the plant operated the entire year without an employe losing one minute's time through accident. This makes the Concrete plant eligible to receive the trophy presented by the Portland Cement Association for a perfect safety record.

Since the Superior company took over the Diamond plant it has been making changes in the equipment, to increase efficiency and output, and cut down manufacturing costs.

The construction outlook is clouded by a high cost element due to the maintenance of wage schedules in the building industry. The year 1932 promises to be a continued period of building readjustment, rather than one of revival in construction activity.

SUPERIOR PORTLAND CEMENT, INC., COMPARATIVE SEVEN-YEAR BALANCE SHEET
(As of December 31)

ASSETS

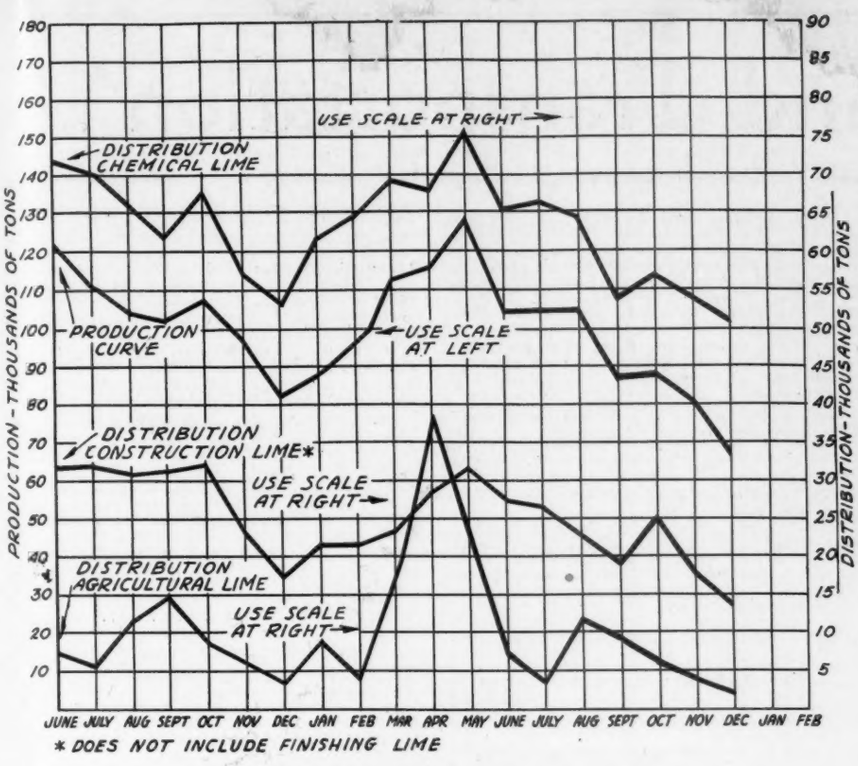
	1931	1930	1929	1928	1927	1926	1925
Cash	$118,268	$251,083	$77,294	$91,338	$23,169	$40,633	$46,688
Investments	337,722	422,575	673,772	771,983	240,789	387,260	192,442
Accounts and notes receivable	126,253	123,080	77,801	110,990	130,009	71,116	64,602
Inventories	341,976	277,463	333,993	310,257	318,389	306,397	312,809
Deferred assets (work in process)	295,476	142,299	168,103	149,369	211,183	149,430	108,381
Total current assets	$1,219,695	$1,216,500	$1,330,963	$1,433,937	$923,539	$954,836	$724,922
Real estate plants, etc.	4,894,187	5,141,880	5,404,214	5,574,770	5,843,975	6,029,546	6,335,821
Total	$6,113,882	$6,358,380	$6,735,177	$7,008,707	$6,767,514	$6,984,382	$7,060,743

LIABILITIES

Accounts and notes payable	$79,294	$18,751	$59,271	$52,004	$52,366	$36,316	$87,083
Payrolls	6,622	12,004	13,081	22,695	24,933	16,706	25,172
Reserve for taxes	36,159	50,009	80,182	193,314	208,068	139,849	155,193
Other reserves	61,256	63,798	51,390	5,374	6,776	6,837	7,865
Total current liabilities	$183,331	$144,562	$203,924	$273,387	$292,143	$199,708	$275,313
Capital and surplus*	5,930,551	6,213,818	6,531,253	6,735,320	6,475,371	6,784,674	6,785,430
Total	$6,113,882	$6,358,380	$6,735,177	$7,008,707	$6,767,514	$6,984,382	$7,060,743
Ratio current assets to current liabilities	6.6 to 1	8.4 to 1	6.5 to 1	5.2 to 1	3.2 to 1	4.8 to 1	2.6 to 1
*Shares of capital stock outstanding:							
Class "A" preferred	75,240	76,145	76,733	81,000	83,178	100,000	100,000
Class "B" common	100,000	100,000	100,000	100,000	100,000	100,000	100,000

Recent Dividends Announced

Cleveland Quarries (qu.)	$0.25,	Mar. 1
Consolidated Sand and Gravel pfd. (qu.)	1.75,	Feb. 15
Schumacher Wall Board pfd. (qu.)	0.50,	Feb. 15
Standard Paving and Materials (Canada) pfd. (qu.)	1.75,	Feb. 15
Superior Portland Cement Cl. A (mo.)	0.27½,	Mar. 1


PRODUCTION - THOUSANDS OF TONS
DISTRIBUTION - THOUSANDS OF TONS
USE SCALE AT RIGHT
DISTRIBUTION CHEMICAL LIME
PRODUCTION CURVE
USE SCALE AT LEFT
DISTRIBUTION CONSTRUCTION LIME*
USE SCALE AT RIGHT
DISTRIBUTION AGRICULTURAL LIME
USE SCALE AT RIGHT
JUNE JULY AUG SEPT OCT NOV DEC JAN FEB MAR APR MAY JUNE JULY AUG SEPT OCT NOV DEC JAN FEB
* DOES NOT INCLUDE FINISHING LIME

Operations of lime industry for 18 months

Production and Distribution of Lime

THE ACCOMPANYING CHART shows statistics of operations in the lime industry for an 18-month period ending with December, 1931.

This information, supplied by the National Lime Association, represents only 43% of the total lime production of the country. Reasonable accuracy in estimating total production should be obtained from it by doubling the amounts shown in the chart.

Committee and Regional Meeting of A. S. T. M.

THE STANDING COMMITTEES of the American Society for Testing Materials will hold their annual spring group committee meetings in Cleveland, Ohio, March 7 to 11. In conjunction with these is the third regional meeting sponsored by the Society, which will be held March 9.

The following committees of the American Society for Testing Materials in which the rock products industry is interested, have signified their intention of holding meetings in Cleveland, at which the work in the various fields covered by the committee in question will be studied and discussed: C-7, on lime; C-9, on concrete and concrete aggregates; and D-4, on road and paving materials.

At the third regional meeting a symposium on rubber is to be held in which outstanding authorities in this field will present papers.

Consider Lime Kilns in Alaska

H. HUDSON of Seattle, Wash., representing the Hodalga Lime Products Corp., and A. D. Myers, representing the Balfour and Gunther Co., of Tacoma, are in Alaska making an investigation of limestone deposits. They were accompanied by W. H. McCullough. If the deposits prove of sufficient quantity, kilns will be established and the finshed product shipped by boat.—*Seattle* (Wash.) *Alaska Weekly.*

Lime Industry in Germany Falls Off

THE German lime industry continued to decline during the fall of 1931. The crisis in the building market became more noticeable, and in some districts led to an almost entire stoppage in sales to the building trade and to factories. Sales of lime for fertilizing declined noticeably in September and ceased entirely in the early part of October, due to the low purchasing power of agriculture and adverse weather conditions. Requirements of sugar factories for this year's operations are also considerably smaller than last year.

Sales of Lime in 1931

THE SALES of lime in 1931 by producers in the United States amounted to 2,710,000 short tons, valued at $18,506,000, according to preliminary figures furnished by lime manufacturers to the United States Bureau of Mines, Department of Commerce. This is a decrease of 20% in quantity and 28% in value as compared with sales of 3,387,880 tons, valued at $25,616,486 in 1930, and follows a decrease of 21% in quantity and 23% in value in 1930 as compared with 1929.

Small demand and lower prices were generally reported for all classes of lime with decreases in output ranging from 8% to 75% for individual companies.

Sales of lime in 1931 for construction are estimated at 970,000 tons compared with 1,204,614 tons in 1930. Sales of lime for chemical uses are estimated at 1,460,000 tons, a decrease of 21% from 1930. The sales of lime for agricultural use are estimated at 280,000 tons, a decrease of 18% in 1931 from 1930.

LIME SOLD BY THE PRODUCERS IN THE UNITED STATES IN 1930 AND 1931

State	1930 Total lime Short tons	1930 Total lime Value	1930 Hydrated lime (short tons)	1931 (estimated) Total lime Short tons	1931 (estimated) Total lime Value	1931 (estimated) Hydrated lime (short tons)
Ohio	736,305	$ 5,711,855	471,785	695,000	$ 4,222,000	430,000
Pennsylvania	633,520	4,661,670	234,192	480,000	3,200,000	186,000
Missouri	265,771	1,861,105	102,166	225,000	1,518,000	87,000
West Virginia	228,230	1,394,075	47,343	152,000	883,000	48,000
Alabama	164,822	929,302	21,380	139,000	758,000	22,000
Tennessee	147,648	855,452	36,670	130,000	708,000	35,000
Massachusetts	107,502	1,072,008	20,432	120,000	1,035,000	25,000
Virginia	146,996	960,219	63,253	99,000	635,000	40,000
Indiana	87,965	600,784	42,126	78,000	457,000	41,000
Illinois	89,709	721,143	32,322	71,000	565,000	26,000
Michigan	80,241	630,288	14,816	56,000	432,000	11,500
Texas	74,081	639,821	32,525	49,000	415,000	25,000
New York	83,078	702,475	37,586	49,000	400,000	21,000
California	51,302	498,795	(*)	41,000	390,000	14,000
Wisconsin	64,989	598,739	10,075	38,000	326,000	8,500
Maryland	53,090	398,841	34,287	35,000	290,000	22,000
Vermont	45,963	406,921	10,052	32,000	268,000	7,100
Arizona	35,642	317,881	(*)	29,000	287,000	(*)
Maine	66,775	542,115	(*)	29,000	240,000	(*)
Arkansas	30,349	241,938	(*)	(*)	(*)	(*)
Minnesota	(*)	(*)	(*)	(*)	(*)	(*)
Utah	27,522	236,607	(*)	(*)	(*)	(*)
Washington	26,913	266,131	(*)	21,000	208,000	4,400
Undistributed	639,467	1,368,321	118,552	142,000	1,269,000	74,500
	3,887,880	$25,616,486	1,329,562	2,710,000	$18,506,000	1,128,000

*Included under "Undistributed."

Traffic and Transportation

Proposed Changes in Rates

THE following are the latest proposed changes in freight rates up to the week ending February 6:

NEW ENGLAND FREIGHT ASSOCIATION DOCKET

24337. **Sand, common** (not molding, fire, filter or blasting) **or gravel,** in straight or mixed carloads (See Note 3), from North Wilbraham and Westfield, Mass., to Hudson, N. Y. Present—North Wilbraham, 6½c; Westfield, 5½c. Proposed—$1 per net ton. (See Note 5.)

24350. **Sand, common** (not molding, fire, filter or blasting) **or gravel,** in straight or mixed carloads (See Note 5), from North Wilbraham and Westfield, Mass., to Oak Street, Bondsville, Enfield, Greenwich and Greenwich Village, Mass. Present—Mileage rates as per B. & A. R. R. I. C. C. 9165. Proposed—50c. (To expire September 1, 1932.) (See Note 4.)

TRUNK LINE ASSOCIATION DOCKET

28505. **Crushed stone or broken stone,** carloads (See Note 2), from Munns, N. Y., to stations on the N. Y. C. R. R. and West Shore R. R.: Greenway, Verona, Canastota, Syracuse, Fernwood, Richland, Lacona, Watertown, Carthage, Lowville, Boonville, Hecla, Wampsville, Kirkville, Cazenovia, Eritown, Lebanon, N. Y., and various. Rates ranging from 80c to $1.50 per net ton. Reason—Proposed rates are fairly comparable with rates from Jamesville and Oriskany Falls, N. Y.

28511. **Sand and gravel,** carloads (See Note 2), from Pinewald, Toms River and Quail Run, N. J., to Tottenville, N. Y., $2 per net ton. (Present rate, $2.18. (See Note 5.)

28514. Cancel present commodity rates on **limestone, ground** (unburned), carloads, minimum weight 50,000 lb., from Watertown, N. Y., to destinations on the B. & M. R. R. and Maine Central R. R. as shown in Items Nos. 7960 to 7980, inclusive, of N. Y. C. R. R. Tariff I. C. C. N. Y. C. No. 15712. Classification basis to apply. Reason—Investigation develops no traffic has moved for some time, nor is there prospects for future shipments, therefore rates are obsolete.

28522. **Slag,** carloads (See Note 2), from Palmerton, Penn., to Erie Railroad stations, Jersey City, Essex Fells, Newark, N. J., Tallmans, Piermont, Monroe, Newburgh, Florida, N. Y., Avoca, Penn., Deposit, Binghamton, Elmira, Watkins, Adrian, Cohocton, Avon, Alexander, Attica, Black Rock, Cuba, Salamanca, N. Y., West End, Paterson, Columbia, N. Y., Spring Valley, Nyack, N. Y., and various. Rates ranging from $1.10 to $2.20 per net ton. Reason—Proposed rates are comparable with rates from Hokendauqua, Penn.

28524. **Trap rock, mine rock, broken stone, crushed stone and stone screenings,** carloads (See Note 2), from Jamesville, N. Y., to Portland, Water Gap, East Stroudsburg or Stroudsburg, Analomink and Henryville, Penn., $1.50 per net ton. Present rate, $1.60 (See Note 5).

28527. **Ground limestone,** carloads, minimum weight 60,000 lb., from York, Union Stone Co., Bainbridge and Billmyer, Penn. To points in Pennsylvania:

	Proposed rate		Proposed rate
Birdsboro	160	Mahantongo	140
Gibraltar	160	Shippensburg	140
Reading	160	Fayettville	150
Shoemakersville	160	Waynesboro	160
Hamburg	170	Chambersburg	150
Duncannon	140	Mercersburg	160
Newport	140	Fort Loudon	160
Millerstown	140	Green Castle	150
Liverpool	140		

Rates in cents per net ton (See Note 5).

28531. To cancel present rates on (1) **stone, natural** (other than bituminous asphalt rock), **crushed,** carloads, (2) **stone, natural** (other than bituminous asphalt rock; **rough building** (other than granite, jasper, marble or onyx), carloads, and (3) **stone, natural** (other than bituminous asphalt rock); **rough building** (other than granite, jasper, marble or onyx, carloads (See Note 2).

From—(1) Woodstock, Md.; (2) Point of Rocks, Md.; (3) Kingwood, W. Va. To Brooklyn, N. Y., St. George Ltg., N. Y., Brooklyn, N. Y.-New York, N. Y.

Reason—Investigation develops no traffic has moved for some time nor is there prospects for future shipments, therefore rates are obsolete.

28553. **Building sand,** in open top equipment, carloads (See Note 2), from Berkeley Springs, Hancock and Great Cacapon, to destinations on the B. & O. R. R., etc.: Philadelphia, Penn., Wilmington, Del., Rosedale, Sparrows Point, Md., Baltimore, Curtis Bay, Md., Washington, D. C., Rockville, Frederick, Brunswick, Hagerstown, Md., Harpers Ferry, Martinsburg, Great Cacapon, Romney, W. Va., and various. Rates ranging from 60c to $1.60 per net ton. Reason—Proposed rates are comparable with rates from Cumberland, Md., to same points.

28555. **Sand (blast, core, engine, fire, foundry, glass, loam, molding or silica),** carloads (See Note 2), from Dunbar, Penn., to Washington, Penn., $1.39 per net ton. (Present rate, $1.62.) Reason—Proposed rate is comparable with rates from Vanport, Ellwood Jct., Jackson Centre, Penn., etc., to Washington, Penn.

28559. **Sand, blast, engine, foundry, molding, glass, silica, quartz or silex,** carloads (See Note 2), from Tatesville, Penn., to Barking, Penn., $1.95, and Clarksville, Penn., $2.10 per net ton. Reason—Proposed rates are comparable with rates from Mapleton district, Penn.

Note 1—Minimum weight marked capacity of car.

Note 2—Minimum weight 90% of marked capacity of car.

Note 3—Minimum weight 90% of marked capacity of car, except that when car is loaded to visible capacity the actual weight will apply.

Note 4—Reason—To meet motor truck competition.

Note 5—Reason—Proposed rates are comparable with rates on like commodities for like distances, services and conditions.

28574. **Crushed stone and screenings,** carloads (See Note 2), from Oak Hall, Penn., to Pennsylvania Railroad stations, Crystal Sand Co. No. 1, Petersburg, Oreminea, Milesburg, Philipsburg, Fowlersville, Burnside, Muncy, Newberry, Du Bois, Canton, Penn., and various. Rates ranging from 60c to $1.30 per net ton. Reason—Proposed rates are comparable with rates from Bellefonte, Pleasant Gap, Union Furnace, Penn., etc.

28580. **Slag,** carloads (See Note 2), from Catasauqua, Penn., to Scale Siding, Pond Creek Jct., Sandy Run Jct., Sandy Run and Upper Lehigh, Penn., 90c per net ton (See Note 5).

M-1975. **Crushed stone,** carloads (See Note 2), from LeRoy, N. Y., to St. Marys, Penn., $1.50 per net ton.

CENTRAL FREIGHT ASSOCIATION DOCKET

30394. To establish on **sand, lake and beach,** carloads, from Michigan City, Ind., to Cambridge City and Connersville, Ind., rate of 150c per net ton. Present, 176c and 202c, respectively.

30401. To establish on **granulated slag,** open top cars, carloads, to Speeds, Ind., from Pittsburgh, Munhall, Kenney Yard, Bessemer, Duquesne and South Duquesne, Penn., rate of 335c per net ton. Present, 29c.

30405. To establish on **sand and gravel,** carloads (See Note 3), from Newark, O., to Frazeysburg, 60c; Trinway, 65c; Conesville, 70c; West La Fayette, 80c; Newcomerstown, 85c; Gnadenhutten, 90c; Dennison, 95c; Bowerston, 100c; Dover, 95c; New Philadelphia, 95c; Summit, 60c; Taylor, 65c; West Jefferson, 85c; South Charleston, 95c; Xenia, 100c; Dayton, 105c; Hilliards, 80c; Plain City, 85c; Milford Centre, 90c; Urbana, 100c; Piqua, 115c; Brink Haven, O., 80c per net ton. Present, sixth class basis.

30430. To establish on **sand, lake and beach,** carloads, from Muskegon, Mich., to Kenosha and Racine, Wis., 103c and 123c per net ton, respectively. Present, 139c (from Muskegon group).

30431. To establish on **limestone, crushed,** carloads, minimum weight 50,000 lb., from Bedford, Ind., to Ottawa, Ill., rate of 190c per net ton. Present, 230c.

30433. To establish on **stone, crushed, in bulk, rough, rubble, rip rap, limestone, unburned agricultural** (in bulk in open top cars only) **and limestone screenings,** carloads, from Painesville, O., to points in Ohio, New York and Pennsylvania, viz.: (representative points) Akron, 90c; Andover, Bedford, 80c; Bundysburg, 70c; Cleveland, 60c; Crestline, O., 105c; Dunkirk, N. Y., Franklin, Penn., 110c; Girard, 85c; Hudson, 85c; Kent, Lorain, 90c; North East, Penn., 100c; Oil City, Penn., 110c; Ravenna, O., 90c; Stoneboro, 100c; Swanville, Penn., 80c; Westfield, N. Y., 100c per net ton. Present, sixth class.

30454. To establish on **crushed stone,** in open top cars, carloads, from McVittys, O., to Zanesville, O., rate of 125c per net ton. Present, 140c. Emergency charge in addition.

30456. To establish on **fluxing stone,** carloads (See Note 3), from Keeport, Ind., to Mansfield, O., rate of 155c per gross ton. Present, classification basis.

30464. To establish on **crushed stone** or **crushed stone screenings,** in open top cars, carloads, from Bellevue, O., to Apex, Dillonvale, Smithfield, Watheys, Braceville, Newton Falls and Phalanx, O., rates of 125c, 135c, 135c, 115c, 90c, 90c, 90c per net ton, respectively. Present, 140c to Apex, Dillonvale, Smithfield and Watheys; 110c per net ton to Braceville, Newton Falls and Phalanx, O., per W. & L. E. Ry. Tariff I. C. C. 1597.

WESTERN TRUNK LINE DOCKET

7833. Rates, mixed carloads: **Limestone, ground and raw mix** in mixed carloads with cement. From Boettcher, Colo., to points in W. T. L. territory. Rates: Present—No provision for mixed carload shipments. Proposed—Publish provision that rates on cement will also apply on ground limestone and raw mix in sacks or barrels, when shipped in mixed carloads with cement.

7844. **Sand, silica,** in box cars, carloads, minimum weights as prescribed by the Interstate Commerce Commission in Docket 17000, part 11-A, from Missouri producing points to Kansas City, Mo.-Kan. Rates: Present—Class or combination. Proposed—Basis prescribed in 17000, part 11-A.

4781-H. Rates and minimum weights, **rock, asphalt, natural or coated** with not to exceed 5% of road oil, crushed or ground; stone coated with not to exceed 5% of road oil, crushed or ground, in straight or mixed carloads, from Pleasanton, Kan., to all stations in Kansas. Rates, present, class rates; proposed, to establish on Kansas state traffic the mileage scale of rates on asphalt rock, etc., as described in Item No. 5 and as published on page 23, Rate Basis No. 10 of S. W. L. Tariff No. 162-D. Minimum weight, present, classification minimum weight; proposed (See Note 3).

2292-I—Rates. **Stone, crushed,** carloads (See Note 3), but in no case shall the minimum weight be less than 40,000 lb., from Ely, Minn., to Chicago, Ill. Rates—Present, 13½c per 100 lb.; proposed, 12c.

981-A—Rates. **Sand, molding,** carloads (See Note 3), but in no case shall the minimum weight be less than 40,000 lb., from Merrimac, Wis., to Detroit, Mich. Rates, present, 26c per 100 lb., or $5.20 per net ton; proposed, $3 per net ton.

ILLINOIS FREIGHT ASSOCIATION DOCKET

3822. To establish rate of $2 per net ton on crude silica sand and $2.40 per net ton on processed silica sand, from Ottawa district to Metropolis, Ill., and $2.60 per net ton on crude silica sand and $3 per net ton on processed silica sand to Paducah, Ky., in lieu of present rates of $2.90 to Metropolis and $3.50 to Paducah.

6473. **Sand and gravel,** carloads (See Note 3), but not less than 60,000 lb., from Joliet, Ill., to Manteno, Kankakee and Hospital, Ill. Present, $1.08; proposed, $1 per net ton.

6474. **Sand and gravel,** carloads (See Note 3), but not less than 60,000 lb., from Plainfield, Ill., to Frontenac, Ill. Present, 50c; proposed, 40c per net ton.

6475. **Stone, crushed; gravel and/or sand,** other than blast, core, engine, filter, etc., carloads (See Note 1), but not less than 40,000 lb., from Joliet, Ill., to stations on the Fox and Illinois Union Ry.

To	Pres.	Prop.
Church Road, Ill.	$0.91½	$0.80
Saratoga	.96½	.80
Central	.96½	.80
Lisbon Center	1.00	.80
Helmar (Kentland), Ill.	1.00	80

(Rates per net ton.)

3718. **Sand and gravel,** carloads, from Pekin, Ill., and Pit No. 5 (Crescent), Ill., to Auburn and Beechley, Ill. Rates per net ton. Present, 88c; proposed, 76c.

3951. **Shale, rock or mine refuse,** carloads (See Note 1), from LaSalle, Ill., to Dixon, Ill. Rates per ton of 2000 lb. Present, 70c; proposed 60c.

4265. **Sand,** except blast, engine, foundry, glass or molding, and **gravel,** also sand and/or gravel pit strippings, straight or mixed, carloads (See Note 3), from Chester, Ill., to Nason, Ill. Rates in cents per net ton. Present, 200c; proposed, 95c.

5767. **Sand and gravel,** carloads (See Note 1), from Brookport, Ill., to McLeansboro, Ill. Rates per net ton. Present, $2.10; proposed, $1.15.

6467. **Stone, viz., stone, ground or pulverized, crushed or rough quarried, also strippings of stone quarries,** in straight or mixed carloads (See Note 3), but not less than 40,000 lb., to Ottawa, Ill., rates per net ton:

From—	Pres.	Prop.
Krause, Ill.	$2.08	$1.55
Valmeyer, Ill.	2.08	1.55

I. C. C. Decisions

21939. Illinois Sand and Gravel. The Interstate Commerce Commission, on further hearing, in **21939,** sand, gravel and crushed stone from Indiana and Illinois points to destinations in Illinois; I. and S. **3093,** sand, gravel and crushed stone from Indiana points to destinations in Illinois; **21372,** Ohio and Indiana Stone Co. vs. C. C. C. & St. L. et al., **23707,** Dickason Sand and Gravel Co. vs. B. & O. et al., I. and S. **3604,** limestone from Mosher, Mo., to Illinois points, and **24298,** Montezuma Gravel Co. vs. B. & O., in a report written by Commissioner Lewis, has ordered a revision of the rates on the commodities mentioned in the territory indicated in the titles of the cases to be made effective not later than March 31. The revision order is based upon findings of unreasonableness, undue prejudice and undue preference.

Minute directions as to how the rates shall be stated are shown in appendices not herein reproduced. The appendices, consisting of many pages of point to point rates, show in detail what the tariff makers will have to do to make their schedules conform with the determinations of the commission.

Commissioner Lewis' summary of the commission's findings follow:

1. "On further hearing, rates to destinations in Illinois on and south of the Terre Haute-St. Louis line of the Pennsylvania railroad on sand, gravel and crushed stone, in carloads, from producing points in Indiana, on crushed stone, in carloads, from Marquette and Cape Girardeau, Mo., and on chat, in carloads, from producing points in Missouri prescribed or approved as reasonable and non-prejudicial for interstate application.

2. "Intrastate rate on crushed stone, in carloads, from Thornton, Ill., to certain destinations in southern Illinois found unduly preferential of the shipper of crushed stone at Thornton and unduly prejudicial to the shipper of gravel at Summit Grove, Ind., and to the shippers of crushed stone at Greencastle, Ind. Undue prejudice and undue preference ordered removed.

3. "Findings in prior report in 21939 and 21372 and Investigation and Suspension Docket 3093, 160 I. C. C. 507, modified in part.

4. "Interstate rates on sand and gravel, in carloads, from Cayuga (Dickason Pit) and Montezuma, Ind., to certain destinations in central and southern Illinois found unreasonable. Reasonable rates prescribed for the future in 23707 and 24298.

5. "Proposed increased and reduced rates on agricultural and ground limestone, in carloads, from Mosher, Mo., to destinations in southern Illinois found not justified, and reasonable and non-prejudicial rates prescribed in lieu thereof. Proposed schedules in Investigation and Suspension Docket 3604 ordered canceled."

23626. Crushed Stone, etc. Alabama Marble Co. vs. L. & N. Report by Commissioner Eastman. Rates, crushed stone or marble terrazzo material, Gantt's Quarry, Ala., to destinations in Texas and other southwestern states, unreasonable, unduly prejudicial and unduly preferential in relation to rates from Whitestone, Fla., to the extent they exceed or may exceed 12% of the corresponding first class rates, minimum 60,000 lb. Undue preference for competitors of the complainant, at Whitestone, to be removed by the establishment of rates from the two points on the same relative basis, not later than April 18. An emergency charge of 12c a net ton, the report said, might be added to the new rates as authorized in the Fifteen Per Cent. Case, 1931, 79 I. C. C. 215. Commissioner Mahaffie, in a separate expression, said he agreed with the finding of undue prejudice but said he thought the rates prescribed should not have been lower than 15% of first class.

24728. Cement. Dewey Portland Cement Co. vs. A. T. and S. F. et al. Rates, cement, Dewey, Okla., to Madisonville and Wichita Falls, Tex., applicable. Applicable rate, shipments, Dewey to Wichita Falls, between March 22 and June 28, 1930, unreasonable to the extent it exceeded 24c, minimum 50,000 lb., subject to marked capacity but not less than 40,000 lb. Reparation proposed. Claims for reparation, shipments from Dewey to Madisonville and on certain shipments, Dewey to Wichita Falls, barred.

24710. Crushed Stone. Gauger-Korsmo Construction Co. vs. M. P. et al. Dismissal proposed. Claim, overcharge, crushed stone, Marquette, Mo., to Memphis, Tenn., barred by the statute of limitations.

Proposed I. C. C. Decisions

24456. Agricultural Lime. Bone Dry Fertilizer Co., Inc., vs. A. C. L. et al. Charges, agricultural lime, Berkeley, W. Va., to Virginia destinations unreasonable to the extent they exceeded those that would have accrued at rates prescribed in North American Cement Corp., vs. A. and R., 153 I. C. C. 431, and 163 I. C. C. 701. Reparation proposed.

Favors Mileage Scale in Setting Crushed Stone Rates

THE INTERSTATE Commerce Commission has before it a recommendation that a mileage scale be applied to the crushed stone and stone screening rates from Rocky Point, Va., to points in North and South Carolina. The recommendation was made by W. J. Harris, examiner.

Reporting on the complaint of the Liberty Limestone Corp., of Rocky Point, against the Chesapeake and Ohio, and other railroads, the examiner found present joint rates "unreasonable" and proposed a scale based on present sand, gravel and slag rates.

The rate recommended would range from $1.33 per ton for 150 mi. to $2.15 for 500 mi., providing that shipments by circuitous routes should not be subjected to charges greater than 20c. per ton over the direct route rate. Several smaller lines, including the Norfolk Southern railroad would be allowed an additional arbitrary charge of 25c. per ton.—*Lynchburg* (Va.) *News.*

Continue Oklahoma Sand and Gravel Case Indefinitely

THE RATE CASE of the Muskogee, Okla., sand and gravel companies, asking to avoid switching charges, has been continued until a time to be set later.

A decision placing junctions near Tulsa in that area had already been made by the corporation commission, but the carriers have asked for a reversal of the decision. After the Tulsa decision was handed down, Muskogee firms applied for a similar decision, as they felt Tulsa firms were given an unfair advantage. Now that the case has been reopened, the two will be heard together, with the two cities cooperating.—*Muskogee* (Okla.) *Phoenix.*

Freight Rates and Heat Units

ACCORDING to a recent article in *The Chicago Purchasor,* freight rates and length of haul should be given careful consideration when purchasing coal. Some coals have higher B.t.u. values than others, but this advantage may be more than offset by higher transportation costs, since freight charges represent 50 to 80% of the delivered costs. Thus, transportation cost per heat unit deserves as much, if not more, consideration than the price f.o.b. mine.

The Chicago metropolitan district, consuming in good times 30,000,000 tons annually, draws its supply from widely separated fields involving hauls as short as 53 miles and as long as 750 miles, with freight rates ranging from $1.16 to $3.35 per ton. The difference in transportation costs on a B.t.u. basis from the nearby Illinois and Indiana mines as compared with more distant fields is shown in the following tables, which are based on an average value of 12,000 B.t.u. per lb. for Indiana and western Kentucky coal and 14,000 B.t.u. for coals from the Appalachian field. The transportation cost per million B.t.u. is as follows:

From	Rate	Freight charges per million B.t.u. (cents)
Brazil-Clinton	$1.61	6.70
Linton-Sullivan	1.71	7.13
Princeton-Ayrshire	1.83	7.63
Boonville	1.86	7.75
Western Kentucky	2.36	9.83
Appalachian high volatile	3.15	11.25
Appalachian smokeless	3.35	11.96

The heat units moved per dollar of transportation cost is as follows:

From	B.t.u. per dollar of freight charges
Brazil-Clinton	14,906,832
Linton-Sullivan	14,035,087
Princeton Ayrshire	13,114,754
Boonville	12,903,226
Western Kentucky	10,169,492
Appalachian high volatile	8,888,889
Appalachian smokeless	8,358,209

These figures indicate that it is more economical to use the nearby fuels, even though of somewhat lower B.t.u. value.

Foreign Abstracts and Patent Review

Aggregate Plant for Construction Job. Some time ago the Vermunt hydro-electric storage dam was completed in the South German Alps. The aggregates for this construction job were obtained by excavation from the detritus of the Ill river at 6620 ft. above sea level and conveyed over a portable railway and a cableway down to the dam-site at the average rate of 140 tons per hour to supply a concrete-making plant producing 78 to 130 cu. yd. of concrete per hour. The construction work at the high altitude was limited to from May to October and excavation was done with two electric-driven bucket chain conveyors, one of these serving as standby.

A plan of the aggregate dressing plant, which consists of units in triplicate, is shown. The raw Ill detritus is interspersed with clay layers so that washing is necessary. Therefore the material having the desired grain size of 0 to 80 mm. or 0- to 3-in. is run through washing machines and only the portion over the 3-in. grade is worked into sand without previous washing by using stone crushers and roll mills.

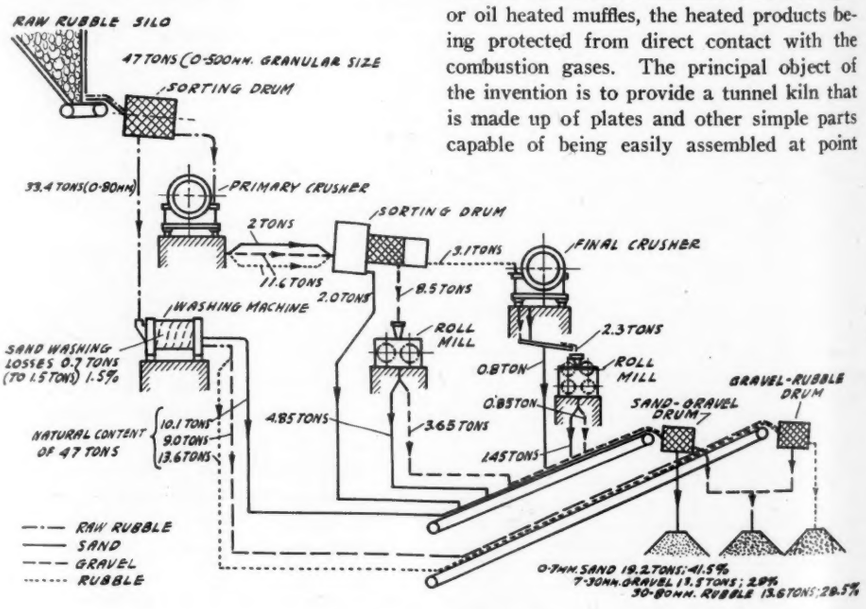
The rubble passes from the bunker to three rough grading drums, over a plate conveyor the speed of which can be regulated to permit adaptation of the quantities fed into the drums to the varying proportion of oversize rock. The driving motors are rated at 4.8 hp. and the plate belts have an effective width of 690 mm. or 2.3 ft., and a distance between pulleys of 1725 mm. or 5.7 ft. The plate belts run at a speed of from 2 to 1 m. or 6.5 to 3.3 ft. per minute. They consist of cast steel plate members spaced 150 mm. or 6 in. apart on centers and a slide regulates the depth of the material carried on the plate belts.

The rubble is carried from each plate belt into a coarse grading drum of 2500 mm. or 8.2 ft. length by 1600 mm. or 5.3 ft. diameter. The drum is equipped with two screening sections, each 1250 mm. or 4.1 ft. long and of a mesh size of 80 mm. or 3 in. for the first and of 100 mm. or 4 in. for the second section. The amount of oversize granules can be increased by partly covering the second section so as to include a certain quantity of 70 to 80 mm. or 2.75 to 3 in. pebbles. The material of a size up to 80 mm. or 3 in. sorted by the drum passes to a washing machine located below the drum, and which can handle 30 cu. m. or 40 cu. yd. per hour and sorts the material under water into sand and gravel at the same time. Each machine requires for washing from 5 to 6 cu. m. or 1100 to 1300 Imp. gal. of water per hour. The sand and gravel separated by the washing machine passes to different conveyor belts.

The material of a size over 80 mm. or 3 in. rejected by the rough-sorting drum is largely turned into sand by passing it through a 600 to 350 mm. or 23.5 to 13.8 in. rock crusher adjusted from 20 to 40 mm. or 0.8 to 1.6 in. The gravel runs from this rock crusher into a grading drum of 8.5 m. or 28 ft. length and 950 mm. or 3.1 ft. in diameter having 35 mm. or 1.4 in. holes and jacketed by a special second screen of 1300 mm. or 4.3 in. diameter and 10 mm. or 0.4 in. mesh. After the sand is sifted out the gravel passes to the hopper of a mill with a roll diameter of 1000 mm. or 3.3 ft. and a width of 320 mm. or 12.6 in. adjusted to a gap of 3 mm. or 0.12 in. The gravel-screen fields are covered by a sheet steel jacket to regulate the quantity going through this mill.

The oversize material from the grading drum up to 60 mm. or 2½ in. then enters a 500 to 300 mm. or 20 to 12 in. finishing crusher and after the sand is extracted, it enters a double roll mill of 400 mm. or 16 in. diameter by 350 mm. or 14 in. width.

The aggregate plant is divided into three sets of equal capacities. Each of the three sets of machines is equipped with one sand and one gravel belt conveyor. These six trough-shaped belts take the washed and crushed material to a main bunker of 3300 cu. yd. capacity subdivided into three cells for storing sand, gravel, and rubble. The roll mills averaging only 60% sand, the gravel-like oversize grain is taken through three sand-screening drums above the main bunker into the gravel cells; while the gravel-like rubble is run by belt to three gravel drums and then distributed over the main bunker. The machine drives are subdivided within each of the three sets of machines. The washing machine and the rough-sorting drum are driven by a 25-hp. motor, the pre-crusher by a 40-hp. motor, the finishing crusher, the mill and the gravel sorting drum by a 40-hp. motor and the rubble-roll mill by a 13-hp. motor over a reduction gear.



Aggregate dressing plant

The composition of the raw material for the aggregate dressing plant is as follows:

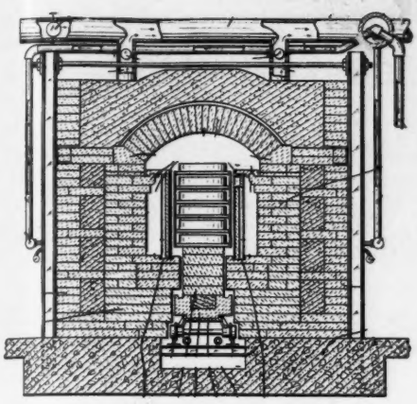
mm.:	0–7	7–30	30–80	80–500
in.:	0–9/32	9/32–1¼	1¼–3	3–20
%	23	19.3	28.9	28.8

Recent Process Patents

The following brief abstracts are of current process patents issued by the U. S. Patent Office, Washington, D. C. Complete copies may be obtained by sending 10c to the Commissioner of Patents, Washington, D. C., for each patent desired.

Non-Skid Paving Surface. The patented method applies especially to roads paved with rock asphalt and the patent specifications mention the Uvalde rock asphalt of Texas. The method consists in spreading a loose layer of crushed asphalt rock which is sized so as to give a balanced mixture, one containing a minimum of voids. On top of this is spread a layer of crushed stone which is harder than the rock asphalt. The layers are compacted together by rolling with a steam roller so that the hard rock is forced into the rock asphalt mixture. *Ernest A. Young, U. S. Patent No.* 1,779,955.

Tunnel Kiln. This invention relates to a muffle-type tunnel kiln. In this type of kiln the heat treated cars travel between gas or oil heated muffles, the heated products being protected from direct contact with the combustion gases. The principal object of the invention is to provide a tunnel kiln that is made up of plates and other simple parts capable of being easily assembled at point



End view of tunnel kiln

of use. The inventor also utilizes the waste heat to preheat the air used at the burners. *Thure Larsson, assignor to Norton Co., U. S. Patent No.* 1,763,624.

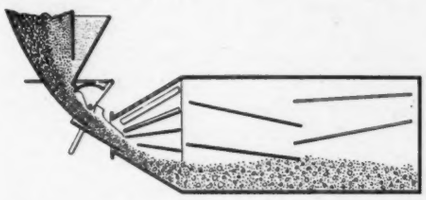
Double-Superphosphate Manufacture. A previous invention of the patentee is to make double-superphosphate by treating phosphate rock with dilute commercial phosphoric acid, heating to consummate the reaction and continuing the heating until the product is dry enough to store or ship. He claims in this patent to have discovered that a better product and a better yield is obtained by drying down to a thick liquid condition instead of a solid, and storing in a pit or tank. After 24-72 hr. the mass sets so that it can be shoveled out or removed by a grab bucket. As it still contains from 10 to 30% moisture it must be further dried before it is shipped or stored. *William Barclay King, assignor to Armour Fertilizer Works, U. S. Patent No.* 1,780,620.

Preparing Road Aggregate. The process differs from others in which crushed stone is coated with a bituminous material in controllng the temperature at which the bituminous material is applied. The stone is first heated to remove all moisture as in the ordinary processes. Then it is allowed to cool, or cooled mechanically, to the temperature at which the bituminous material will set, and the application is made at that temperature. The setting of the material prevents it from flowing and results in a uniform coating all over each piece of stone. *L. Wittenberg, assignor to the Barrett Co. of New York, U. S. Patent No.* 1,791,109.

Process of Manufacturing Portland Cement. The inventor, who is vice-president and manager of a large portland cement manufacturing company, says that he has discovered that if previously calcined and ground cement clinker is added to raw mix the calcining of the mix may proceed at a lower temperature than usual and that the resultant cement will have a high early strength and possess superior hardening qualities to portland cement made in the usual way. It is believed by him that the ground clinker (or cement without gypsum) added acts as a catalyzer. It is stated that the gypsum may be added, but it is preferred to use the plain ground clinker. In the specifications and the claims it is stated in every instance that the clinker which is to be ground and added to the raw mix is made of the same materials as the raw mix. The best results were obtained with a 20% addition of ground clinker, but favorable results have been had with additions varying from 5% to 25%.—*James H. Colton, assignor to Pacific Portland Cement Co., Consolidated, U. S. Patent No.* 1,791,800.

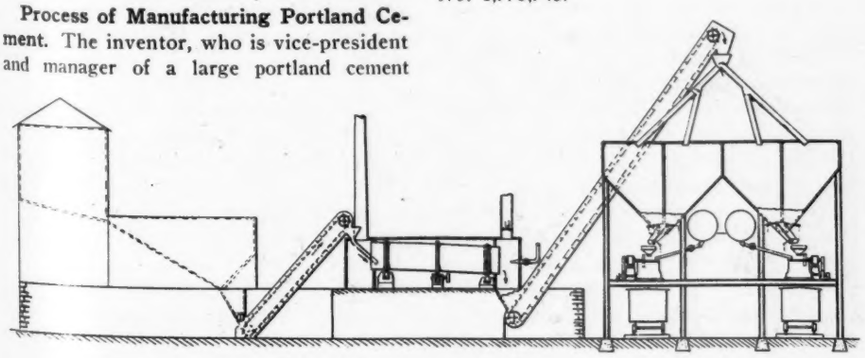
(Note—The addition of *unground* clinker to the raw mix to be ground with the mix is covered by patent of Guy S. La Forge, U. S. Patent No. 1,784,840.—Editor.)

Method of Charging Concrete Mixers. Gravel, sand and cement are weighed into a horn shaped charging hopper in the order named. The gravel rests on the curved surface of the hopper, the sand rests on the



The hopper is designed to insure more thorough mixing

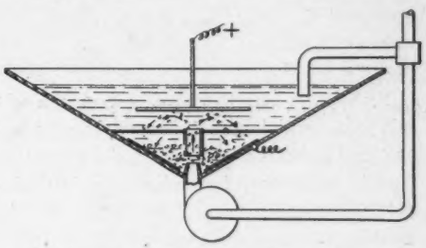
gravel and the cement on the sand. The mixer is revolved and the materials are allowed to flow from it into the hopper. The gravel, which is the most flowable material, carries the cement and sand with it the length of the mixer so that the mix is uniform from the start. This method is especially applicable to mixers which are long in proportion to the diameter, such as are used on trucks which deliver ready mixed concrete. *Porter W. Yett, U. S. Patent No.* 1,775,745.



Plant for preparing bituminous road aggregates by a new process

Making Roofing Granules. The method coats granules of slate or other rock with a metal, such as copper, by electroplating. The granules are first covered with graphite or by carbon, a method of doing this being to coat the granules with coal tar pitch and to pass them through a bath of melted lead which carbonizes the pitch. Another method of making the coating is to cover the granules with an oxidized coating like linseed oil and then with such a salt as the suboxide of lead which will be reduced to metallic lead by heating.

After the surface is made conductive by any of these, or similar methods, the metal is deposited electrolytically. As an alternative, it is mentioned that molten metal may



Device for coating roofing granules with a metal surface

be sprayed on the granules, although all the apparatus shown in the cuts is for electrolytic deposition of the metal.

The simplest form is that shown. The conical tank in the illustration is connected to the negative side of a plating dynamo and the anode, a flat plate hung in the tank, to the positive side. The solution of copper sulphate or other metallic salt is circulated by the pump below. Other illustrations show methods of continuous feed and discharge of the granules. One device resembles a tube mill, the anodes being hung around the shaft. After they are coated with metal the granules are attached to a felted base with asphalt that will not melt in solar heat. *Harold L. Levin, assignor to Anaconda Sales Co., New York, U. S. Patent No.* 1,789,443.

Artificial Stone and Method for Making. This is a modified cinder block. The cinders are crushed if necessary and then screened and washed to remove dust and fines. They are then mixed with cement, water and a filler consisting principally of calcareous material, containing a small percentage of silica, crushed to pass a 10-mesh sieve. The proportions preferred are: Washed cinders, 70%; calcareous material, 10%, and cement, 20%. Although they are not named, from the analyses given, it might be supposed that either crushed limestone or crushed dolomite would serve as a filler. The inventor says that the cinders should be thoroughly saturated before being used, as this results in more uniform hardening. He also claims that the block is nailable, fire-resistant, practically sound proof and that it offers considerable resistance to water. *Irving J. Smith, U. S. Patent No.* 1,782,748.

Sand and Gravel Producers Discuss Bituminous Roads

Final Session of Pittsburgh Convention Given Over Largely to Discussion of Use of Gravel with Asphalt or Other Bituminous Mixtures

SUPPLEMENTING publication of the proceedings of the convention of the National Sand and Gravel Association, in our issue of January 30, papers were read at the Friday session on the use of bituminous mixtures for road surfacing. The paper by **Bernard E. Gray,** highway engineer, the Asphalt Institute, New York City, is abstracted below:

Today the purchaser of gravel can obtain commercial gravel accurately prepared to any grading desired, and tested to comply with careful standards. It is doubtful if any other mineral aggregate may be used in so many different satisfactory ways as this one. Gravel by itself has high support value under traffic; combined with bitumens it can be made into an enduring surface of the highest type.

There are, of course, situations where local gravel has an advantage over the commercial gravel because of availability with shorter haul, but as the technique of using gravel has been developed and perfected, one important factor stands out more and more clearly, viz.: that essential characteristic of uniformity of surface. Furthermore, when a uniform material is used, new construction may be accelerated and maintenance materially reduced. The methods described, therefore, are adapted particularly well to the utilization of commercially prepared gravel.

As a result of certain limited tests carried on several years ago, the idea became prevalent that to obtain proper traffic support, a homogeneous slab of certain minimum thickness must be constructed. I take the opportunity at this time to assert most vigorously that these tests resulted in conclusions which are but a part of the complete picture.

I. Surface Treatment of the Natural Soil

The first method of using gravel is the one of surface treatment of the natural soils. Varying amounts of gravel are worked into the surface, ranging from 100 to 200 tons to the mile. The depth of this surfacing in one instance was only about 1 in., and it was not anticipated that the improvement could be completed in one year, but would be carried on over three or four years until stabilization had been obtained.

Experiments were begun by the Minnesota highway department in 1925, using asphaltic road oils. The results obtained were little short of amazing. It was demonstrated that well consolidated gumbo roads, treated with asphalt and covered with sandy gravel, will afford an excellent year-round surface that will carry traffic ranging from 600 to 1500 vehicles per day. The first treatment employs about 1000 cu. yd. of gravel to the mile for a surface 30 ft. wide. The asphalt is applied in three applications, the first one being a prime which is allowed to be absorbed without any cover coat. The second application is immediately covered with the gravel, and the asphalt and gravel are mixed by blading the surface until of uniform texture, after which the mixture irons out under traffic. A light seal coat is then given with a light gravel cover. The total cost of this surfacing is about $1500 per mile. The second year a retreatment usually is required and thereafter one every two or three years. Total costs averaged over a period of seven years have been from $500 to $700 per mile, including new gravel and asphalt. Gravel for this work usually has been shipped in from outside, as there is little gravel found within the gumbo area. These are two instances of how very thin surfaces may be constructed with gravel and asphalt, and be entirely satisfactory for moderate traffic.

The question naturally arises as to the use of roadside pit gravels versus commercially prepared gravels. There are, of course, some locations where roadside gravel is available at very low cost, and of good quality. Under such circumstances it is economical to make use of such material. In the great number of cases, however, gravel must be shipped in from outside sources, and commercially prepared material is always advantageous under such conditions. In any surface construction the element of uniformity is most important, and it becomes outstandingly so as soon as bituminous treatments are given. It will be found, therefore, that while commercial gravels are sometimes higher in cost than the roadside bank gravel, the exact grading and size of aggregate obtained, the lower cost of manipulation, due to the absence of oversize particles which have to be removed from most local bank material, and the uniform texture of the finished surface, all contribute to the choice of standard *prepared* gravel whenever available. From my own experience, I am convinced of the wisdom of always purchasing commercially prepared aggregates *whenever available,* rather than endeavoring to obtain such materials from roadside pit operations which are not equipped to properly prepare materials.

II. Gravel Surfaces with Asphalt Treatments

The next group of surfaces are roads where gravel has been laid in substantial depth, but where the growth of traffic necessitates considerable material replacement, so that treatment with asphalt becomes economical. This traffic point is usually around 300 to 400 vehicles daily. There are two principal kinds of gravel surfacing, which are differentiated from one another by the amount of cementitious material contained therein. In one kind the gravel particles are loosely bound together, but nevertheless have very high stability due to the mechanical structure. In the other group are gravels which contain a certain amount of clay or other binder, so that the surface becomes very quickly bonded under the action of traffic and the weather. In Texas, for instance, a considerable mileage of loose gravel is being bonded with a relatively small percentage of limerock.

Cover-coat aggregate may vary according to the kind of surface treatment employed. With fine sandy gravels, the same kind of gravel may be used for cover coat in the prime treatment, but for seal coat cover and retreatments it is desirable that the gravel shall be partially crushed. The percentage of crushed particles will vary according to the character of the gravel itself. With all seal coat and retreatment work it is desirable to have the mat of the minimum thickness that will insure complete coverage and waterproofing. When properly prepared the underlying surface is hard and firm, so that the cover coat aggregate should be sufficiently angular to contact with this surface and become cemented to it by the asphalt in such a way as to completely resist displacement under traffic. Some very excellent work has been accomplished with uncrushed pea gravel, where the individual particles were irregular in shape. With smooth round quartz gravels at least 50% of the particles should have a fractured face.

Loosely bonded gravels—The cover material for the first bituminous application consists of the loose material previously swept to the side. The second application consists of a quick-drying asphalt cut-back, which is immediately covered with 25 to 35 lb. of chips per sq. yd.

The second year a retreatment is given at the rate of ¼ gal. to the square yard, with about 25 lb. of gravel for cover, after previously repairing any small areas which may

have developed during the winter. During subsequent years treatments will be required at intervals of from two to three years, according to conditions, but the quality of the surface will show continuous improvement and the repairs will become fewer and fewer.

Cementitious gravels—The material should be thoroughly consolidated by grading and dragging, and all weak places should be replaced with new material. All wet areas should be thoroughly drained. It usually is desirable to allow such surfacing to go through one or more winters in an untreated condition in order to develop all such places and to obtain proper stability. The first application of asphalt is a priming one, the purpose being to penetrate the surface to a depth of approximately 1 in. This "kills" the dust and also hardens and binds the particles together so that a firm bond can be obtained with the seal coat.

Maintenance consists first of draining out pockets by a small trench to the gutter and back-filling with crushed stone or gravel. The surface repair consists of a patch made with the cover-coat material and asphalt cut-back, similar to the seal coat. This kind of maintenance will occur during the first year, or possibly two years, by which time underdrainage will have been completed, and breaks in the surface will practically cease. Thereafter maintenance will consist of periodic surface treatments, including prime-coat, seal-coat and cover-coat, ranging from $800 to $1500 per mile for 20-ft. width, varying according to length of haul and cost of aggregate. Maintenance costs, including cost of retreatments, rarely exceed $500 per mile for the first three years, and tend to decline steadily thereafter.

III. Road-Mix Surfaces

These surfaces are known throughout the country under a variety of names, such as "mixed-in-place," "oil processed," "retread," etc., but for the sake of simplicity the new construction manual of the Asphalt Institute defines these types as "road-mixes" to differentiate clearly from "plant-mixes." These surfaces have been placed under a variety of conditions and with such excellent results that they are rapidly growing in popularity. They have three outstanding and advantageous characteristics—low cost, rapid construction, and unsurpassed smoothness.

There are two distinct types of road-mix surfaces which are differentiated by the character of the mineral aggregate used. In one type the aggregate consists of a continuously graded gravel ranging from about 1 in. in diameter down to and *including dust*. In the other the aggregate is graded from about 1½-in. to ¼-in. diameter and *free from dust*. These two types are known respectively as the graded aggregate type and the macadam aggregate type. In the coarse aggregate type, work has been done both with crushed and uncrushed gravel. The majority of engineers feel that a substantial portion of the particles should be crushed. The required amount varies according to the character of the gravel itself and the angularity of the individual particles. In this type the inherent stability or load-supporting capacity of the compacted aggregate is dependent principally upon the interlocking of the individual fragments and *not* upon the packing of the voids with fine material. In my opinion, therefore, to insure such interlocking, at least 60% of the particles should have a sharply fractured face.

For the design of high stability surfaces with the graded aggregate type, a formula based on the sieve analysis has been developed, for which discussion the space allotted here is inadequate; but, generally speaking, the grading is from 35 to 60% passing the 10-mesh and 7 to 14% passing a 200-mesh, with 25 to 50% consisting of the coarser particles up to 1 in. In making a selection between the two road-mix types the builder will be guided by the character of the existing road surface and the availability and cost of the new gravel required. Generally speaking, gravel roads should be surfaced with the graded aggregate type, while macadam bases, chert, shale and similar tightly bonded surfaces should be covered with the macadam aggregate type.

Advantages of Gravel Aggregates

Right here it may not be amiss to clear up a misunderstanding with reference to the two types of road-mix surfaces. Owing to the fact that relatively little of the graded aggregate type has been laid in the East, the attention of gravel producers has been directed almost entirely to the macadam aggregate type, with considerable discussion as to the percentage of crushed particles that are required and the relative stability of gravel vs. other types of crushed aggregate. In one case the question was raised to the effect that the gravel producer was not interested in the graded aggregate type because his material was always a washed material, and therefore free from the 200-mesh size. As you will know, it is a fact that usually the percentage of sand recovered along with the gravel is of considerable amount, and therefore the graded aggregate type affords an opportunity to dispose of the entire plant output. Furthermore, a very large volume of gravel has been sold for the construction of gravel roads which have been constructed by the mulching method, where the gravel and the underlying subgrade have been mixed together until a stable surface has been obtained. When these old surfaces are scarified and new gravel, including sand, added, a sieve analysis of the mixture will often show the presence of a sufficient amount of 200-mesh material, and it is confidently predicted that as soon as this type of surface is tried out where sandy gravels are available at reasonable cost, it will grow quickly in popularity because of its many advantages.

One very great advantage of the graded aggregate type is the opportunity afforded to rework the surface as may be necessary, even after a year or more. While a firm crust is very quickly developed under traffic, yet light scarifying will make it possible to reblade the surface and correct any depressions which may develop during the first few months, and also to add either additional asphalt or gravel to produce the highest possible stability of surface.

Coarse Aggregate Type—This type may be placed on any sound roadbed as a base, including macadam, cementitious gravel, chert, shale, sand-clay, etc. It is an excellent method for improving a surface where growing traffic requires increased stability and better wearing qualities, and it fits into a scheme of stage construction to excellent advantage. When placed on surfaces not previously treated, a priming operation is required, using approximately ⅓ gal. per sq. yd. without cover. This primer penetrates the surface and "kills" the dust, thus waterproofing the surface and preventing any loose materials from working up into the road-mix proper. The road-mix aggregate is then spread evenly to a depth of approximately 2½ in. loose, and treated with cut-back asphalt at the rate of ½ gal. to the sq. yd. Thorough mixing is accomplished by using multiple-bladed drags, harrows, graders, or combinations of such equipment. A second application of asphalt follows, with further mixing until a "tacky" condition occurs, after which the mixture is spread out smooth and even and rolled.

Several weeks later (in any event, before the following winter) a seal coat is provided. Crushed gravel is spread over the surface at the rate of 35 lb. to the square yard, with an application of asphalt at the rate of ⅓ gal. per sq. yd. The gravel and asphalt are thoroughly dragged to insure complete mixing and also the correction of any irregularities, after which the surface is thoroughly rolled. The depth of finished surface may be varied from 1 in. to 2½ in., but for a definitely new wearing course a compacted depth of 2 in. is found to be usually most desirable. The lesser depths are employed where the surfacing is made over old bases having a high crown, and where variations in depth are necessary to obtain a flat crown in the finished road. The type has been particularly successful for such reconstruction work. The amount of asphalt will also vary somewhat according to the character of the gravel aggregate itself, and such adjustments are quickly made as the work progresses.

Costs—The cost of the graded aggregate type, including both the gravel and the asphalt, averages around 35c per sq. yd. Thus, for a 20-ft. width, the cost per mile ranges from $3000 to $4000. Maintenance costs, including retreatments, average around $300 per mile. The cost of the macadam aggregate type runs slightly higher, ranging from 25c to 50c per sq. yd., a mile of roadway 20 ft. wide costing from $3000 to $5000. Maintenance costs are at the maximum the first year after construction, and steadily decline thereafter. They will average around $400

per mile, including retreatments. The selection of type depends upon availability of aggregate and the type of existing roadbed. Usually the choice is apparent for economic reasons, the traffic-carrying capacity of the two types being approximately the same, so that this factor seldom bears in making a decision.

Plant-Mixes

There are two general groups of plant-mixes using asphalt and gravel, and they cover all ranges of traffic-support to such an extent that it is hard to conceive of a situation where one or the other will not give the highest kind of service. The first group is the asphaltic concrete, hot-mixed type, wherein the gravel, sand and asphalt are mixed in a standard asphalt plant and the resulting mixture is placed upon a suitable foundation to a compacted depth of from 2 to 3 in.

For mixtures of the highest stability a certain amount of crushed aggregate is desirable. For instance, the California specifications give the following grading for base course:

Passing a 200-mesh sieve	2% to 4%
Passing an 80-mesh sieve	8% to 14%
Passing a 40-mesh sieve	15% to 20%
Passing a 10-mesh sieve	20% to 30%
Passing a 3-mesh sieve (0.263)	30% to 40%
Passing a screen with ¾-in. circular openings	50% to 65%
Passing a screen with 1¼-in. circular openings	65% to 75%
Passing a screen with 2½-in. circular openings	90% to 100%
To the above shall be added asphaltic cement (Grade "D")	4½% to 5½%

Screened gravel may be used for that portion of coarse aggregate which passes a screen with ¾-in. circular openings, which you will note is as much as 65%. The sizes from ¾-in. to 2½-in. should be of crushed particles.

For surface coarse the grading shall be as follows:

Passing a 200-mesh sieve	7% to 11%
Passing an 80-mesh sieve	15% to 20%
Passing a 40-mesh sieve	23% to 30%
Passing a 10-mesh sieve	28% to 36%
Passing a 3-mesh sieve (0.263)	40% to 55%
Passing a screen with ¾-in. circular openings	75% to 90%
Passing a screen with 1¼-in. circular openings	90% to 100%
To the above shall be added asphaltic cement (Grade "D")	5% to 6½%

Screened gravel may be used for that portion of the coarse aggregate which will pass a screen with ½-in. circular openings approximately 75%. The sizes from ½-in. to 1¼-in. should be of crushed particles.

In calling for a certain percentage of crushed particles, the entire object is to insure stability through interlocking of the fragments. Where the gravel is naturally angular, the percentage of crushed particles may be materially reduced in amount for base or binder courses, while for the surface coarse all particles may be uncrushed when of similar character.

In addition to using the asphaltic concrete as a surface course, more and more attention is being given to the use of the coarse-graded mixtures for asphaltic concrete base courses. These are frequently referred to as "black bases." They permit the use of a coarse grading and thus utilize the entire plant output for the mixture. Such mixtures produced in quantity and laid by mechanical means can be placed for less than $5 per ton, or about $7 to $8 per cu. yd., complete in place. This figure is below that of any other possible comparable mixture, volume for volume. The fine graded asphaltic concrete is placed for a wearing course to a depth of approximately 2 in., and may be renewed as required without disturbing the base.

Cold-Mixes

The second group of plant-mixes are the so-called "cold-mixes," and is a method of placing the graded aggregate type of "road-mix" by doing the mixing at a plant instead of on the roadbed. Several advantages are gained by this method, especially where all of the aggregate is to be shipped in and none is to be obtained from the existing gravel surface on the road. One advantage is that a higher viscosity asphalt may be used; another, that the grading of the gravel may be closely regulated, and a third, that the mixture may be made up in volume and stored during periods of weather when road construction would be impossible. The cold-mix asphaltic concrete utilizes a slow-curing asphalt, so that after the surface is laid it may be remanipulated with a scarifier and grader to correct inequalities and depressions which may occur in the surface during the first year. Such mixtures may be made up in thousands of tons in volume and stored at the plant, and then, when the roadbed has been made ready, may be trucked out quickly and long mileages finished at a very rapid rate with a minimum inconvenience to traffic.

A modification of the plant-mix method, which is of relatively new development, is found in the portable plant which operates over the roadbed, takes the aggregate from a windrow, mixes it in the machine and deposits the finished mixture on the road surface behind. The finished mixture can be spread and compacted either by using tractors and graders, or it may be finished mechanically with one of the several types of mechanical finishers. One machine recently developed produced such a mixture at the rate of 48 cu. ft. a minute, which is equivalent to 10 linear feet of roadbed 20 ft. wide. This would make possible the construction of a new asphaltic gravel surface at the rate of approximately one mile per day, using only one plant.

Conclusions

The foregoing descriptions of the principal types of gravel asphalt surfaces are intended as a condensed outline of the most important features of the work. Of necessity, they omit many details. In conclusion it is desired to emphasize the following:

1. That gravel and asphalt may be combined to produce such a wide range of surface types; that there is one to be selected for every climatic and topographical situation and every volume of traffic.

2. That every proper engineering principle of design, such as adequate drainage, careful grading and careful inspection, should be applied to such surfaces, ever keeping in mind, even with the simple stabilization methods and the asphalt-treated gravel surfacing, that by such methods all this work may be made to serve as a foundation for new surfaces as traffic increases in the future.

3. That such combinations of asphalt and gravel can be constructed over a very large mileage at costs that afford excellent competitive advantage.

4. That the rapid development of mechanical mixing and finishing which is now taking place, together with intensive research as to the accurate proportioning of aggregates and asphalt, will greatly increase the rate of construction and reduce costs.

5. Finally, that the country is now entering upon a new phase of highway development and that more miles are to be constructed in the next ten years than during the past decade. They will cost less money, however, probably not more than one-third of past per-mile expenditures, and they will be largely bituminous types. In this new work, gravel will find a very large field of usefulness.

Discussion

Mr. Gray's paper was discussed by **C. N. Conner,** engineer-executive, American Road Builders Association, Washington, D. C., and by **Geo. E. Martin,** of the Barrett Co., New York City, both agreeing with Mr. Gray's conclusions. The discussion indicated that an increasing amount of bituminous road building is being done and that for this work more gravel is being crushed in order to compete with stone and clay.

Road Bulding Programs

Chas. M. Upham, engineer and director of the American Road Builders' Association, Washington, D. C., emphasized the urgent necessity of carrying on the highway programs. He stressed the importance of having the emergency bill passed and the need

of a continuation of road work and feared that unless further efforts are made the road programs will be reduced, there having been $84,000,000 less road work done in 1931 than in 1930.

He pointed out that any cessation of road work would increase unemployment and result in making general conditions worse. He also urged that every possible effort be made to stop the diversion of gasoline tax funds to other uses, such diversion having already been started in nine states.

Dealers and Producers Merge in Milwaukee

ORGANIZATION of the United Materials Corp., an amalgamation of 23 Milwaukee companies dealing in building materials and fuel, with sales in 1931 of more than $5,000,000, was announced January 24.

Articles of incorporation, providing for 50,000 shares of no par value, were to be filed at Madison by Attorney C. J. Otjen, representing the new concern. When the preliminary legal work is completed officers of the new concern will be selected. Philip W. Grossman and R. H. Whitehead, who have been active for several months in forming the combination, are scheduled to head the new concern.

The names of the firms to be absorbed in the amalgamation have not been revealed, but included will be 11 building material companies, 11 sand and gravel companies, four concrete block manufacturing companies, six retail fuel companies and two stone quarries. This is more than the 23 announced, but the discrepancy is due to the fact that some of the companies deal in more than one item.

The new organization will be the largest of its kind in the state and is formed, it is stated, to effect greater economy in distribution and administration and to meet better the needs of those dealing with purveyors of building materials. The affairs of the various companies will be directed from a central office.—*Milwaukee* (Wis.) *Journal.*

To Build $350,000 Sand Plant

A PLANT which is expected to cost approximately $350,000 and employ more than 100 men, is to be established at Enterprise, in Carter county, Ky., within the next 60 days and is to be known as the Tavern Rock Sand Co., a subsidiary of the Illinois-Owens Glass Works, it was learned recently.

T. A. Graham, Millville, N. J., who is to be general manager of the newly established company, announced that he had purchased 275 acres of land where the plant will be built and that it would be ready for operation by the latter part of March.

The glass sand is to be obtained from this property and will be crushed, screened and cleaned and then placed in railway cars and shipped to the main plant of the Illinois-Owens Glass Works.—*Ashland* (Ky.) *Independent.*

DATA FROM 1930 CENSUS OF THE SAND AND GRAVEL INDUSTRY, FURNISHED BY U. S. BUREAU OF THE CENSUS, SHOWING TYPES OF SAND AND GRAVEL OPERATIONS AND PERCENTAGES OF PRODUCTION BY DIFFERENT OPERATING METHODS

Type	Number of enterprises	Number of plants	Tonnage	Value
Shovel only	227	274	43,165,000	$25,341,000
Shovel and dragline	73	91	16,090,000	7,688,000
Shovel and dredge	36	46	9,995,000	5,520,000
Dragline only	234	275	25,180,000	14,877,000
Dragline and dredge	37	59	7,379,000	4,607,000
Pump dredge	266	308	42,505,000	24,008,000
Ladder dredge	58	63	16,471,000	12,719,000
All other	26	49	8,101,000	7,553,000

POWER DATA ON THE SAND AND GRAVEL INDUSTRY: 1929

Kilowatt hours generated			7,594,828
Kilowatt hours purchased			237,679,291
Cost of purchased current			$4,921,398
Prime movers:			
Steam engines			
Number	1,653		
Horsepower	158,150		
Steam turbines			
Number	10		
Horsepower	740	Aggregate horsepower	516,745
Internal-combustion engines			
Number	1,125		
Horsepower	72,207		
Electric motors driven by purchased energy			
Number	7,732		
Horsepower	285,648		
Electric motors driven by energy generated by enterprises reporting			
Number			212
Horsepower			6,591
Electric generators			
Number			42
Kilowatts			3,828
Total cost of fuel			$3,989,503
Coal:			
Anthracite			3,804 tons (2240 lb.)
Bituminous			601,588 tons (2000 lb.)
Coke			133 tons (2000 lb.)
Fuel oil			16,909,461 gal.
Gasoline and kerosene			5,708,451 gal.
Gas:			
Manufactured			52,560 M cu. ft.
Natural			82,213 M cu. ft.

Settle Claims Resulting from Sand and Gravel Boat Sinking

SIX CLAIMS for damages growing out of the sinking in July, 1930, of the Kelley Island Lime and Transport Co.'s steamer, *George J. Whelan*, have been settled recently.

The widow and son of Arthur Walters received $15,000; the widow and two sons of Carl A. Biechle, $15,000; the widow of Ralph Weis, $2500, and the estates of William Neuschler, Harry Brooks and W. R. Longnecker, all unmarried, $2500 each.—*Cleveland* (Ohio) *Press.*

Expands Operations

THE Muskingum River Sand and Gravel Co. of Zanesville, Ohio, is planning to enlarge its operations in the Muskingum river with the addition of a digger dredge having a capacity of 1000 tons daily.

The new sand digger is named *The Snipe* and was taken over from the Allegheny River Sand Corp. It was taken to Parkersburg, W. Va., several months ago and rebuilt. The boat is 120 ft. long and 34 ft. wide.—*Zanesville* (Ohio) *Times-Record.*

Urges State to Buy Gravel Direct

RECOMMENDATION that the state highway department adopt the same policy relative to the purchase of gravel for road construction purposes that it now has in regard to cement and steel, has been made to the state department of administration and finance and Commissioner Babcock by Representative Atwood of Winona, the latter announced recently.

Savings which will result from district purchase of gravel will amount to more than $200,000 annually, Representative Atwood said, adding that many other members of the state House of Representatives are in accord with his suggestion.—*St. Paul* (Minn.) *Dispatch.*

Erratum

IN THE DISCUSSION of the Review of the Research of Concrete Aggregates in 1931, which was given in the January 9 issue of Rock Products, under tests for soundness, page 107, the limit of disintegration for complete unsoundness after five cycles was given as 15%. This figure should have been 20%.

Ed. Shaw's News Letter From Los Angeles

STANLEY HANDS came by one morning recently and took me for a visit to some of the jobs he is overseeing. His title is that of Junior Testing Engineer of the Division of Highways, but his work seems to include a great deal of concrete technology. Most readers of ROCK PRODUCTS are familiar with his articles on the methods of design used in California, on stabilizing the aggregate industry and so on; articles which have not only aroused a great deal of interest but which have added at least one important method to the study and design of concrete, and method of determining the amount of water required by the separate components of a mix.

During the trip I saw Mr. Hands design concrete by the absolute volume method, which is now used a great deal in this state. To one who knows absolute volume methods only by the papers and articles that have been written about them, they seem rather involved and to require a great deal of weighing and calculation as compared with the simple water-cement ratio method as given, for example, in the Portland Cement Association's manual. But, after you see it done, designing by absolute volumes looks just as simple as any method.

Since all proportion is (and must be) by weight, the first step is to find the specific gravity of the materials. This is done by the pycnometer, a long name for what is in effect a quart fruit jar with a conical top that screws on. The fruit jar has now been displaced by an aluminum cylinder, the glass jar being too breakable for field work. Supposedly, everyone who is interested enough to read this knows how to find the specific gravity of an aggregate sample with the pycnometer or Chapman flask, and also how to determine moisture in sand by the same or an equivalent device, so that part of the work will not be described here. There were four determinations: the specific gravities of sand; No. 1 coarse aggregate (¼-¾-in.); No. 2 coarse aggregate (¾-1½-in.); and the moisture in the sand. The specific gravities were all the same, 2.5, materials being in a surface dry condition, and the moisture in the sand was 5.9%.

To design by absolute volume one must know the cement per yard and the water-cement ratio. In this case the cement was 6 sacks per cu. yd. and the water-cement ratio was 0.83. From this it is easy to figure how much of the volume of the concrete will be taken up by the cement and the water by the equation:

$$27 - 6\left(\frac{w}{c} + 0.48\right) = K$$

in which 27 is the number of cubic feet in a yard, 6 is the number of sacks of cement (cubic feet) in a yard of the concrete, w/c is the water-cement ratio, and 0.48 is the absolute or solid volume in 1 cu. ft. of ground cement. The answer, K, is the solid volume of the fine and coarse aggregates together. In this case K equals 19.14, the water-cement ratio being 0.83.

If you think about it you will see that if you specify the water-cement ratio you specify K. But it is equally true that if you specify K you specify the water-cement ratio. And contractors who have objected to a specified water-cement ratio have not offered the least objection to a specification that said that the total solid volume of the aggregates in 1 cu. yd. of the concrete should not be less than, for example, 19.14 cu. ft.

Trial mixes had now to be worked out. The starting point for this is the proportion of sand. On highway work, where the water-cement ratio is lower and K equals about 20, the rule is to use 6.5 to 7.5 cu. ft. of sand if the coarse aggregate is gravel and 7 to 8 cu. ft. if the coarse aggregate is crushed stone. In this case, with K equal to 19.14, the sand was taken as one-third of K, or 6.38 cu. ft. It was desired to have the No. 2 coarse aggregate about 40% of K (7.67 cu. ft.), and this left 5.09 ft. for the No. 1. To get the weight of each, these *absolute* or solid volumes had to be multiplied by the specific gravity and also by the weight of 1 cu. ft. of water, thus:

$6.38 \times 2.5 \times 62.5 =$ 996.8 lb. or 33.3%
$5.09 \times 2.5 \times 62.5 =$ 795.3 lb. or 26.7%
$7.67 \times 2.5 \times 62.5 =$ 1198.4 lb. or 40.0%

Before this could be tried in the mixer for workability it was necessary to see if it would meet the grading requirement for such concrete. The state issues a chart on which the sieve analyses of the materials are plotted. From the plots of the components the plot of the complete aggregate was made in a few minutes. It was found that the curve came outside the lines that showed the limits for this class of concrete, being low in the No. 1 coarse aggregate section. So the No. 1 was increased to make the mix 33.3% sand, 31.3% No. 1 and 35.4% No. 2. This was plotted and found to be still outside in the No. 1 section. The next and final change was to 33.3% sand (997 lb.), 35.4% No. 1 (1059 lb.), and 31.3% No. 2 (963 lb.). It was left to the judgment of the engineer in charge to make the slight changes that might be needed for better workability. But if he decreased the weight of one component he would have to increase the weight of either or both of the others in order to keep the absolute volume always the same. For this is the important point about this method, that the absolute volume and the water used being kept the same, *both the yield and the water-cement ratio will be constant*, the only change being in the grading or proportion of fine to coarse.

Where the specific gravities of the three components are not the same there is a little more work. But the time and effort in any case is not great. It takes about three minutes to make a specific gravity determination after the weight of the flask and so on is standardized. All the calculations can be made with a slide rule. To do the work given above required less than an hour. Mr. Hands tells me that in laying highway concrete the mixes can be figured and tried and everything brought to running condition before 20 ft. of pavement are laid.

Of course the moisture in the sand has to be watched. On ordinary jobs the sand only is weighed, using a platform scale that costs less than $20. The other aggregates can be measured in a box made to hold the required weight, or part of it. The variations in coarse aggregate weight due to moisture are too small to be very significant.

It is the same way with grading. With two classes of coarse aggregate there is not much chance for the coarse aggregate end of the mix to vary. But variations in the sand have to be watched, especially if the material comes from more than one source.

In all these things "the proof of the pudding is in the eating," as the old proverb has it. And I was pleased to look over some records that show that the concrete laid by the highway department and that which goes into bridges is not only strong but that it is uniform in quality and that the yield is kept constant by the methods that have been worked out in the state's laboratory and in the field.

Claims Gravel Company Trespasses in Dredging

FOR VIOLATION of her riparian rights, Margaret E. Whitely filed suit in circuit court January 23 for recovery of $40,000 damages against the River Sand and Gravel Co. of Owensboro, Ky. Mrs. Whitely recites in her petition she is the owner and in possession of what is known as Yellow Banks Island, across the Ohio river from Owensboro, but a part of Daviess county, in Kentucky.

For five years past, the petition recites, the defendant company has been digging sand and gravel from the bed of the stream on her land, for which they have paid her nothing.

Under the Kentucky law, plaintiff alleges, her land extends to the bed of the stream, which the defendant company has trespassed. She asks for judgment in the sum of $40,000. —*Owensboro* (Ky.) *Messenger.*

Thirty-Seven Cement Plants Win Safety Award

ON DECEMBER 31 the ninth and greatest of the annual safety trophy contests of the Portland Cement Association was successfully concluded. Forty-three plants completed the year without lost-time or more serious accident; 37 of these are eligible to receive the trophy award or re-award. The remaining six burnt clinker for an aggregate of less than six months and therefore fail to meet the operating minimum required for the award. Two plants won the trophy for the fifth consecutive year.

The 1931 winners bring the total number of awards and re-awards to 138 and the total number of plants having trophy monuments to 87. There are now only about 40 plants in Association membership eligible for participation in the contest which have not yet won at least once. Thirty-four per cent. of the operating plants within association membership completed the year 1931 without injury to a worker sufficient to cause loss of pay; in 1930, 33% of the operating member plants were similarly accident-free; and in 1929, 19% made an equally good record.

Of the cement plants, with their quarries, which have won the 1931 award, 18, or 50%, are winners for the first time; an equal number have won during one or more previous years. Of the six plants which were unable to win because of short operating season, five had previously received the award. Eighteen plants completed the year with only one lost-time accident each, and have already been enrolled on the list of probable winners for 1932.

Some of the excellent results of the trophy contest are apparent from the following analysis of awards since it was established in 1923:

Year	Number of awards
1923	1
1924	1
1925	2
1926	2
1927	10
1928	16
1929	26
1930	43
1931	37
	138

Of the list of 87 mills which have earned a total of 138 awards, two have won five awards (both have records of five consecutive years without lost-time accident), one has won four awards, 10 have three awards, 20 have two awards, and 54 have one award.

Geographically, the result of the Portland Cement Association's contest are far-flung. The number to win the award in various regions is as follows: In New York state and New England, 5; Lehigh Valley, 5; Ohio, 4; central west, 2; southeastern states, 4; Texas 3; Mississippi river to the Rockies, 4; Pacific Coast states, 7; Canada, 3; Cuba, 1. The most remarkable showing as to proportion of winners to the number operating was on the Pacific Coast, where no accidents occurred in eight of the 16 competing mills, although only seven can qualify for the award. The largest plant to receive the 1931 trophy is the Universal Atlas organization at Northampton, Penn., which exceeds in respect to both volume of production and man-hours worked any plant previously achieving a perfect safety record. The mill of the Cuban Portland Cement Corp., Cayo Mason, Cuba, which won in 1930, was the largest in point of man-hours to win up to that time, is conspicuous among the winners again in 1931.

The Iola, Kan., plant of the Lehigh Portland Cement Co. again heads the list with longest continuous accident-free period, amounting to 1939 consecutive days. The Ironton, Ohio, plant of the Alpha company is again "runner up" with 1849 days to its credit up to January 1, 1932. Both of these plants are winning the award for the fifth time. The plant of the San Antonio Portland Cement Co. is a winner for the fourth time, although not for four consecutive years. The Medusa group of mills, which includes the Manitowoc and Newaygo plants, obtained the highest proportion of perfect records of any of the multiple plant organizations, five of its eight mills experiencing no lost-time or more serious accidents, although only two are eligible for the trophy award. Lehigh again made an excellent record with six plants out of 13 operated avoiding mishaps and an equal number qualifying for the award.

Among the records of the 1931 trophy winners are several which show unusual improvement. The mill which occupied a position at the bottom of the safety list with 86 lost-time accidents in 1927 had but 17 accidents in 1928, 9 in 1929, 8 in 1930, and in 1931 was able to complete a full year's operation of 365 days without a lost-time accident or even necessity for shifting the occupation of a single employe. Another mill newly started in 1927 was far down the list with 23 accidents in 1928. In 1930 it reported four accidents and in 1931 it entirely avoided lost-time mishaps. The 18 mills which won the safety trophy for the first time in 1931 had a combined total of 203 lost-time and 8 fatal accidents five years ago, the combined record improving steadily since that time.

Under the rules of the Portland Cement Association's contest, a workman who is injured in such manner that it is not advisable for him to continue at his usual occupation for a short period, but who suffers no general incapacitation, may be transferred with the consent of the surgeon and the foreman to any other bona fide position (not created for his benefit) which he is capable to hold without impairing the safety record of the plant.

This regulation has been the subject of contention for several years, some members feeling that it is too liberal. However, the preponderance of opinion holds that much loss of time has been avoided by this rule and that it is desirable from every viewpoint to encourage regularity and continuity of service. It is contended that a slightly injured man is better off if gainfully occupied under supervision and with medical aid available, than if left to his own devices, unsupervised and possibly disturbed over loss of pay. Many companies feel that it is safer so far as their interests are concerned to have a slightly injured man under observation of the company physician or nurse than at home or running around.

In view of the interest taken in this regulation it is interesting to note that slight injuries in winning mills have been so few during recent years that only an occasional plant takes advantage of the rule referred to above. Of this year's 37 trophy winners only four plants shifted men as a result of an accident. The total number so shifted was only seven. Record of this practice among the trophy winners was as shown below.

The extent to which the practice of shifting men for minor injuries has shrunk during the past few years indicates a splendid reduction in classes of accidents which have encouraged this practice in the past.

To the Victors Belong the Spoils

The awards "hung up" by the Portland Cement Association to the winners of its contests are well worth the effort, costing on the average about $1000 per mill. The Association will place orders shortly for the construction of 18 of the large cast stone monuments, each one a handsome carved casting made of portland cement and Mount Airy granite. Cored, to reduced weight and facilitate handling, the new trophies will

OCCUPATION TEMPORARILY SHIFTED WITHOUT PENALTY

	Regular work	Temporary employment	Days on temporary employment
1.	Clinker trapper	Laborer	7
2.	Coal miller	Storeroom inventory helper	9
3.	Packer	Car checker	30
4.	Laborer	Laborer—restricted assignment	42
5.	Laborer	Laborer—restricted assignment	5
6.	Block hole driller	Powder man's helper	7
7.	Cement stacker	Laborer—sweeper	3

C. A. SWIGGETT
F. C. BROWNSTEAD
W. J. WORTHY
W. J. MONTZ
R. H. MACFETRIDGE
J. H. COLTON
A. T. BEVIER
H. A. REICHENBACH
J. W. CAMPBELL
F. E. TOWN
W. D. ARMSTRONG
H. O. RINEHOLD
A. A. CHANEY
JOHN RAE
W. W. DEADMAN
H. A. AMBLER
J. S. DOWNS
W. M. CABANISS
F. DAVIS
E. W. BAILEY
A. P. DEJONCKHEERE
R. H. TOWNSEND
R. W. MCALLISTER
A. K. FROLICH
J. YOUNG
W. T. GRONER
F. P. MONAGHAN
H. E. NICHOLS
A. L. WOLF
A. F. KRABBE
R. A. BECHTOLD
B. E. MERRELL
M. W. WINSCH
H. HELWIG
C. M. CARMAN
Superintendents
of
1931 SAFETY TROPHY WINNING MILLS
PORTLAND CEMENT ASSOCIATION

MEMBER PLANTS OF THE PORTLAND CEMENT ASSOCIATION AWARDED SAFETY TROPHIES FOR 1931

(No lost-time or fatal accidents reported from these plants for the period indicated)

Company	Plant	Superintendent	Date of last disqualifying accident	Days clear to Jan. 1, '32
*Lehigh	Iola, Kan.	C. A. Swiggett	Sept. 9, 1926	1939
*Alpha	Ironton, Ohio	F. C. Brownstead	Dec. 8, 1926	1849
*Medusa	Toledo, Ohio	W. J. Worthy	Apr. 5, 1928	1365
*Lehigh	Ormrod, Penn., No. 2	Wm. J. Montz	July 25, 1928	1254
*Lehigh	Birmingham, Ala.	R. H. MacFetridge	Aug. 25, 1928	1223
*Pacific	Redwood City, Calif.	A. G. Lang	Nov. 27, 1928	1129
*Great Lakes	Buffalo, N. Y.	A. T. BeVier	Dec. 29, 1928	1107
Canada	Port Colborne, Ont.	L. M. McDonald	Apr. 12, 1929	993
*Nazareth	Nazareth, Penn.	H. A. Reichenbach	Apr. 16, 1929	989
*North American	Howes Cave, N. Y.	J. W. Campbell	Aug. 17, 1929	866
*Manitowoc	Manitowoc, Wis.	F. E. Town	Oct. 2, 1929	820
*Canada	Exshaw, Alta.	W. D. Armstrong	Dec. 5, 1929	756
*San Antonio	San Antonio, Tex.	H. O. Rinehold	Dec. 10, 1929	751
*Trinity	Fort Worth, Tex.	A. A. Chaney	Dec. 12, 1929	749
*Cuban	Cayo Mason, Cuba	John Rae	Dec. 19, 1929	742
*Lone Star Ala.	Spocari, Ala.	W. W. Deadman	Jan. 11, 1930	719
Superior	Concrete, Wash.	H. A. Ambler	Jan. 23, 1930	707
*Herculues	Nazareth, Penn.	J. Stanley Downs	Feb. 10, 1930	689
*Lone Star Ala.	Birmingham, Ala.	W. M. Cabaniss	Mar. 2, 1930	669
Santa Cruz	Davenport, Calif.	Fred Davis	Apr. 14, 1930	626
Canada	Lakefield, Ont.	E. W. Bailey	May 24, 1930	586
Yosemite	Merced, Calif.	A. P. DeJonckheers	June 12, 1930	567
Calaveras	San Andreas, Calif.	R. H. Townsend	June 30, 1930	549
Pittsburgh Plate Glass	Fultonham, Ohio	Robt. W. McAllister	July 7, 1930	542
*Lehigh	Ormrod, Penn., No. 3	Wm. J. Montz	July 15, 1930	534
Ash Grove	Louisville, Neb.	A. K. Frolich	Aug. 16, 1930	502
Lehigh	Oglesby, Ill.	John Young	Sept. 20, 1930	467
Southwestern	Osborn, Ohio	W. T. Groner	Oct. 2, 1930	455
Glens Falls	Glens Falls, N. Y.	F. P. Monaghan	Nov. 20, 1930	406
Southwestern	El Paso, Tex.	H. E. Nichols	Nov. 24, 1930	402
Lawrence	Thomaston, Me.	A. L. Wolf	Dec. 1, 1930	395
Olympic	Bellingham, Wash.	A. F. Krabbe	Dec. 9, 1930	387
Penn.-Dixie	Valley Junction, Ia.	R. A. Bechtold	Dec. 16, 1930	380
Univ. Atlas	Leeds, Ala.	B. E. Merrell	Dec. 17, 1930	379
Univ. Atlas	Northampton, Penn.	M. W. Winsch	Dec. 17, 1930	379
Lehigh	Metaline Falls, Wash.	H. Helwig	Dec. 27, 1930	369
Univ. Atlas	Independence, Kan.	C. M. Carman	Dec. 30, 1930	366

MEMBER PLANTS WITH PERFECT RECORDS BUT INELIGIBLE FOR 1931 TROPHY BECAUSE OF NOT HAVING BURNED CLINKER FOR AN AGGREGATE OF SIX MONTHS

*Canada	Ft. Whyte, Man.	V. C. Hamilton	Nov. 28, 1929	763
*Newaygo	Newaygo, Mich.	L. E. Smith	Dec. 11, 1929	750
*Medusa	York, Penn. (white)	R. J. Landis	Sept. 12, 1929	840
*Medusa	Bay Bridge, Ohio	A. J. Little	Nov. 1, 1929	790
*Cowell	Cowell, Calif.	E. D. Barnett	Nov. 22, 1930	769
Alpha	Jamesville, N. Y.	E. L. Boyne	June 23, 1930	556

*Previous trophy winner.

provide space for the depositing of historical documents, list of names of the men who helped to win it, photographs, and objects of future historical interest.

During the latter part of May the first trophies will be delivered to the winners and unveiling and dedication ceremonies will probably continue as usual throughout the remaining months of the year. Plants which have won previously will be authorized to have their present monuments reinscribed at Association expense.

According to the rules of the contest, each winning mill may send two delegates to the spring meeting of the Portland Cement Association in May with necessary traveling and hotel expenses paid. The entire group to attend the Association meeting in the spring will consist of 74 picked men, one of the most representative bodies of employes to assemble on behalf of the active safety work of any industry.

Railroad distance to be traveled by the delegates will be the longest traveled by any group of similar delegates up to this time, owing to the exceptional number located in Pacific Coast states and in the far south. An estimate places the entire amount of travel at approximately 200,000 mi., an average of about 2700 mi. per delegate.

Formal award of the trophies is expected to take place in New York City in May. The outlook for the 1932 trophy contest is considered very promising. It seems possible, from the excellent start that has been made, for as many as 60 plants to win during the present year.

Cement Prices in Canada

ONE of the outstanding features shown in a study of industrial results in Canada for the past year is the rather remarkable stability in cement production, as compared with a number of years previous. Not only was production well maintained, even in 1931, but the average of prices kept surprisingly firm.

Completes Five Years Without Accidents

FIVE YEARS—1826 days—without a lost-time accident. That is the record which has been made by the Alpha portland cement plant of Ironton, Ohio, according to announcement December 8 by F. C. Brownstead, superintendent.

As a result of its accomplishment the Ironton plant retains its position as second in the Portland Cement Association in the matter of safety achievements.

Letters and telegrams of felicitations were received by Superintendent Brownstead from various cement plant attaches and association officials throughout the country.

The committee which has worked untiringly in an effort to sustain the Ironton plant's safety record is composed of the following Alpha employes:

W. L. Patterson, mine department, chairman; William Butler, mine department; Walter Carmen, shale mine; J. S. Beddal, laboratory; John Dole and Oscar Taylor, mill; Henry Hafle, electrical; A. C. Manis, power; J. B. Hall and A. A. Madden, office; A. McCarley, bag department; C. E. Whitlatch, packing, and W. A. Brooks, sales office.—*Ironton* (Ohio) *Tribune.*

Announce Prize Winners

ANNOUNCEMENT of winners of the blasting cap guessing contest held at the recent convention of the National Crushed Stone Association by the Hercules Powder Co., Wilmington, Del., has been made.

There were 3,133 caps in the bowl. Winners among operators were: Frank S. Jones, general superintendent, General Crushed Stone Co., first prize; E. T. Nettleton, sales manager, Connecticut Quarries Co., Inc., second prize, and L. F. Miller, New York Trap Rock Corp., third prize. Exhibitors who won prizes were George S. Ernshaw, Illinois Powder Co., first prize; Roy Willis, advertising manager, Ohio Power Shovel Co., second prize; and Delbert Kay, advertising manager, Nordberg Manufacturing Co., third prize.

W. M. Powell Leads Safe Drivers' League

W. M. POWELL, safety director of the Medusa Portland Cement Co., has been selected by the Portland Cement Association and National Safety Council to recommend plans for a new organization for highway safety to be known as the Safe Drivers' League.

The new movement is unique in that it will aim directly at reducing highway accidents through the agency of manufacturing concerns and industrial workers.

Mr. Powell has been in Chicago assisting in the organization of the movement.—*Sandusky* (Ohio) *Star-Journal.*

Committee of A. S. T. M. to Study Mortars for Unit Masonry

A NEW STANDING COMMITTEE of the American Society for Testing Materials has been organized to undertake work in the field of mortars for unit masonry. This committee, which has been designated C-12 on mortars for unit masonry, has the following scope:

"Research to promote knowledge of properties and tests of mortars for unit masonry and development of methods of test and specifications for such mortars. It is intended that the activities of the committee shall be closely correlated with other interested committees of the society."

At a meeting held in June, organization was effected with temporary officers and a temporary advisory committee which have continued to function during the past few months in the completion of the personnel of the committee and in the development of a subcommittee organization.

While tremendous strides have been made in the knowledge and use of mortars in the thousands of years during which they have been used, there is still a great deal to be learned about the various types. This subject is an important one and many millions of dollars are expended annually for structures in which mortars are an important material. An idea of how extensive the work of committee C-12 will eventually be is given by a review of the subcommittee organization.

Subcommittee Organization

One of the most important activities of the committee will be the correlation of research investigations that have been carried out on masonry mortars and a determination of the present gaps in existing knowledge. A subcommittee on correlation of research is accordingly contemplated in the committee's organization. Since many features of specification requirements and test procedures are involved, a rather extensive subcommittee organization has been determined upon by the temporary advisory committee.

1. *Advisory*—To outline the activities of the committee and to conduct the business of the committee between meetings.
2. *Publications*—To act as an editorial committee in the preparation of reports and to establish general publication policies.
3. *Correlation and Research*—To bring together such information as is in existence regarding masonry mortars and to correlate these data; to lay out research programs and to correlate research activities.
4. *Specifications*—To prepare specifications for masonry mortars of various classes.
5. *Definitions*—Define terms employed in masonry construction and to standardize the use of such terms.
6. *Testing Apparatus and Testing Methods*—To devise apparatus and testing methods for standard mortar tests as required by subcommittee on specifications.
7. *Cementing and Plasticizing Materials*—To gather information concerning various cementing and plasticizing materials, their properties and uses.
8. *Mortar Sands*—To gather information concerning the mortar sands in common use in various parts of the United States, the effect of character of sand upon the various properties of mortars including strength, plasticity and shrinkage.
9. *Preparation of Mortars*—To make a study of the practice in the use of mortar materials and in the proportioning and mixing of mortars; to make a study of the possibility of improving practice in the use of mortar materials.
10. *Unit Masonry Construction Practice*—To make a study of the practice regarding unit masonry construction of all classes, to correlate these practices and to carry out such investigations as are necessary for improved practice.
11. *Plasticity Tests*—To organize and carry out such programs of investigation as are necessary to establish adequate methods of determining plasticity, consistency, rate of hardening; to study effect of various cementing and plasticizing materials upon plasticity, and to set up plasticity standards.
12. *Strength Tests*—To review the results of such strength tests as have been made both upon mortars themselves and upon masonry specimens. To formulate an adequate program of tests to determine the factors which influence strength of masonry in compression, flexure and shear.
13. *Volume Change Tests*—To organize and carry out such tests as may be necessary to determine volume changes and the factors which influence them.
14. *Durability Tests*—To make a study of test methods for determining the durability of masonry and to organize and carry out a program of tests which will establish the factors which influence durability.
15. *Permeability Tests*—To organize a program of building and laboratory research which will seek to determine the factors which affect permeability and to establish methods of masonry manufacture which will insure impermeable walls.
16. *Efflorescence and Staining*—To make such field and laboratory investigations as may be necessary to establish the causes of efflorescence and staining and remedies therefor.

Members of New Committee

The personnel of the committee is given below:

Temporary Officers—Chairman, R. E. Davis; vice-chairman, J. C. Pearson; vice-chairman, T. R. Lawson; secretary, C. L. Warwick.

Temporary Advisory Committee—Stanton Walker, J. W. McBurney, D. E. Parsons, M. O. Withey.

Producers of Materials for Mortars

Cementing Materials:

Allentown Portland Cement Co., W. H. Andrews, supervising chemist, Conshohocken, Penn.

L. E. Johnson, secretary and general manager, Finishing Lime Association of Ohio, Toledo, Ohio.

Louisville Cement Co., H. D. Baylor, vice-president, Speed, Ind.

Medusa Portland Cement Co., W. L. White, Jr., assistant general manager, Cleveland, Ohio. (Alan Jackson, alternate.)

National Lime Association, N. G. Hough, president, Washington, D. C. (L. S. Trainor, alternate.)

J. C. Pearson, director of research, Lehigh Portland Cement Co., Allentown, Penn.

Portland Cement Association, H. F. Gonnerman, manager, Research Laboratory, Chicago, Ill. (C. G. Walker, alternate.)

Riverton Lime Co., W. E. Carson, president, Riverton, Va.

Utica Hydraulic Cement Co., S. G. Seaton, chief chemist, Utica, Ill.

Warner Co., J. A. Murray, chief chemist, Devault, Penn.

Aggregates:

National Crushed Stone Association, A. T. Goldbeck, director, Bureau of Engineering, Washington, D. C.

National Sand and Gravel Association, Stanton Walker, director, Engineering and Research Division, Washington, D. C.; also C. E. Proudley, assistant director.

National Slag Association, R. E. Roscoe, chemical engineer, Bessemer Cement Co., Youngstown, Ohio.

Producers of Masonry Units

American Face Brick Association, G. S. Eaton, secretary-treasurer, Chicago, Ill.

H. S. Brightly, secretary-director, Building Stone Association of Indiana, Bloomington, Ind.

Cast Stone Institute, Chicago, Ill. (representatives to be appointed).

Clay Products Institute of California, N. W. Kelch, secretary-manager, Los Angeles, Calif.

Common Brick Manufacturers Association, J. W. McBurney, research associate, Bureau of Standards, Washington, D. C.

Gypsum Association, H. J. Schweim, secretary and chief engineer, Chicago, Ill.

National Terra Cotta Society, W. F. Lockhardt, secretary-director, New York City.

Structural Clay Tile Association, E. C. Kerth, engineer, secretary, Chicago, Ill.

U. S. Gypsum Co., C. K. Roos, research manager, Chicago, Ill.

Consumers and General Interests

American Institute of Architects, Prof. C. M. Gay, School of Fine Arts, University of Pennsylvania, Philadelphia, Penn. (F. Leo Smith, alternate.)

F. O. Anderegg, consulting specialist on building materials, Pittsburgh, Penn.

R. E. Davis, professor of civil engineering, University of California, Berkeley, Calif.

J. W. Ginder, superintendent, Architectural Engineering Division, U. S. Treasury Dept., Washington, D. C.

T. R. Lawson, professor of civil engineering, Rensselaer Polytechnic Institute, Troy, N. Y.

L. A. Palmer, Masonry Mortar Research Fellowship, Bureau of Standards, Washington, D. C.

D. E. Parsons, chief, Masonry Construction Section, Bureau of Standards, Washington, D. C.

M. O. Withey, professor of mechanics, University of Wisconsin, Madison, Wis.

J. R. Withrow, professor of chemical engineering, Ohio State University, Columbus, Ohio.

W. D. Guion, commissioner of buildings, Cleveland, Ohio. (informally representing Building Officials Conference).

Several of the standing committees of the society are interested in the work of the new committee and are represented thereon by members, who will serve in a liaison capacity.

Cement Production in Canada in November

SALES OF CEMENT by Canadian producers in November amounted to 792,535 bbl. as compared with 1,126,834 bbl. in October and 713,643 bbl. in November last year. Dominion Bureau of Statistics records show a production during the 11 months ending November, 1931, of 9,697,429 bbl. or 8.9% below the previous year.

Makes Equipment for World's Largest Gravel Plant

THE WORLD'S LARGEST gravel plant, having an annual capacity of 5,000,000 tons, being built by the Construction Materials Corp. in Ferrysburg, Mich., will be provided with equipment to unload scows; convey, crush, wash, classify, and store material; and deliver it in any combination of sizes to railroad cars, boats, or trucks. Ships will be unloaded at the rate of 3600 tons an hour.

The entire plant will be controlled by one operator by means of a special drum which will set up any one of a number of different operations. Before being shipped, all disconnect switches, control switches, relays, and other control for each motor, or for each group of motors in one location, will be grouped together on pipe frame supports with interconnecting wiring. Approximately 4,000 hp. in motors is being provided. All motors, control switchboard, "V" belt drive, lighting equipment, and No-fuse panelboards are being supplied by the Westinghouse Electric and Manufacturing Co., East Pittsburgh, Penn.

The plant was designed by Charles M. Rudow, consulting engineer of Chicago, Ill.

Settle Gravel Suits

TWO SUITS filed by James U. Watson against the Northeast Missouri Sand and Gravel Co. operating near New London, Mo., have been settled in the Ralls county circuit court. Under the settlement it is stated that Mr. Watson was paid for the gravel and that the defendant paid the court costs. In addition to this it is stated that the company recognizes Mr. Watson as the owner of the land.

One of the cases was a replevin suit wherein Mr. Watson filed suit for gravel amounting to about 15,000 tons on the theory that the company without Mr. Watson's consent had improperly taken the gravel from his land.

The other suit was for trespass wherein the plaintiff sought damages against the company, alleging it had, without his consent, taken from the land certain gravel and refused to pay for it.

This ends the litigation and paves the way for development of the gravel operations.—*Center* (Mo.) *Herald.*

Trade Shows

"HOW EXHIBITORS Are Meeting the Trade Show Problem" is the title of a survey recently completed by the Policyholders Service Bureau of the Metropolitan Life Insurance Co., a report of which has been published.

The information on which the study is based was obtained from 84 trade associations sponsoring national or regional shows.

New Manufacturer of Dust Collectors

BLAW-KNOX CO., Pittsburgh, Penn., announces the appointment of M. I. Dorfan as manager of its dust collector division.

Mr. Dorfan has just terminated a five-year engagement as manager of the dust collector division of the Pangborn Corp. He was previously in charge of dust collector sales for the Allis-Chalmers Manufacturing Co.

M. I. Dorfan

The Blaw-Knox Co. is entering the dust collector field with two lines of equipment developed and ready for the market and other lines in process of development.

Mr. Dorfan is a member of the steel blast research committee of the National Safety Council, contributing editor to the *Guide* of the American Society of Heating and Ventilating Engineers, a member of a number of engineering societies and has been a well-known figure in designing and selling dust collecting equipment for many years.

New Pavement Awards

CONCRETE PAVEMENT yardage awarded in the United States during the month of January as reported by the Portland Cement Association is:

	Yardage awarded during January, 1932
Roads	2,252,048
Streets	234,134
Alleys	38,031
Total	2,524,213

Sand Company to Dissolve

A SPECIAL MEETING of stockholders of Columbia Sand and Gravel Co., Inc., was to be held at the company's office, Alexandria, Va., January 8, to act on a resolution adopted recently by the company directorate deeming it advisable and for the benefit of the corporation that it be dissolved.

Last February, acquisition of the company by the Arundel Corp. of Baltimore, was announced.

A note accompanying the notice of the meeting states that the charter of the company provides that in the event of its voluntary dissolution, holders of preferred stock shall be entitled to be paid in full the par amount of their shares and accrued dividends thereon, before any amount shall be paid to holders of the common stock.

The note further states that assets of the company are sufficient to pay for outstanding preferred stock at par with accumulated dividends and that upon dissolution, holders will be notified to present their stock and receive payment.

The latest edition of Facts and Figures on Washington Securities, compiled by Y. E. Booker and Co., lists the capitalization of the company as comprising an authorization of $1,200,000 7% cumulative preferred stock of $100 par value, of which $1,046,000 is outstanding, and an authorization of 12,000 shares of no par common stock, unlisted, of which 10,460 shares are outstanding. Preferred stock of the company is listed on the Washington Stock Exchange and its last sale was at 90.

The company, which was the successor to the Columbia Granite and Dredging Corp., has been engaged in dredging sand and gravel and marketing it in the District of Columbia and surrounding territory.—*Washington* (D. C.) *Post.*

Sues for Damage from Water Seepage Into Quarry

CLAIMING that leakage of barge canal waters into his stone quarry in Albion, N. Y., forced him to discontinue working the quarry, Frank Colonna is suing the state of New York for $46,000.

The action is being tried before Judge Owen L. Potter in the Court of Claims, Rochester. Mr. Colonna seeks to recover losses he claims to have sustained from 1921 to 1930 through seepage of canal waters into his quarry. In 1926 he worked the quarry and the state settled losses for $2200.—*Albion* (N. Y.) *American.*

To Beautify Quarry in Unemployment Relief Work

WORK on the Sorin's hill footpath and the clearing out of the old quarry, a project planned to provide jobs for unemployed at Red Wing, Minn., has begun.—*Red Wing* (Minn.) *Republican.*

Cement Products

TRADE MARK REGISTERED WITH U. S. PATENT OFFICE

Vertical Garden of Precast Units

Novel Concrete Product Developed by E. W. Rice, Chief Chemist, Santa Cruz Portland Cement Co., Davenport, Calif.

A "STRAWBERRY WALL" is the name given a concrete product developed by E. W. Rice, chief chemist, Santa Cruz Portland Cement Co., Davenport, Calif.

Having a rather small lot, Mr. Rice decided to try vertical farming, with results as shown in accompanying views.

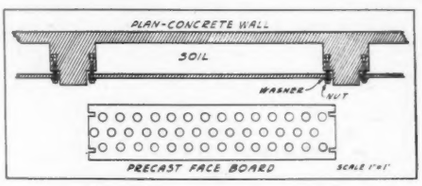
The wall as built is about 20 ft. long and 6 ft. high and constitutes the back lot line fence, giving the wall face a southern exposure.

The wall contains 645 holes, only half of which are utilized for planting, the remainder being for drainage and aeration. There is an 8-in. space between the back wall, which is of reinforced concrete, and the precast face boards. This allows plenty of soil for the growth of crops. It also allows changing of the soil as may be required.

The entire wall is irrigated simultaneously, from the top. A small concrete trough runs level along the top of the wall, and small ¼-in. pipe outlets are provided which may be controlled as desired by plugs. The irrigation process is controlled by the opening of a ¼-in. cock. Easy and uniform percolation of the irrigation water is provided for when the soil is placed by using a movable dividing board in such a manner that a 1-in. vertical layer of coarse sand is left against the back wall, extending from bottom to top.

The first trial crop of 1928 consisted of: (1) strawberries in entire right section; and (2) onions, parsley, lettuce, peppers, cucumbers, squash, watermelons, radish, beets, spinach, green corn, and tomatoes.

The melons, squash and cucumbers were



Details of wall construction

planted on top at left, and the resultant crop reposed on the top of the washroom. The green corn grew on top of the wall. The tomatoes produced prolificly on the bottom, Mr. Rice reports.

When it came time to harvest the green onions and beets it was founds that they had grown so large that they could not be pulled through the holes, so this part of the crop was a failure.

The strawberries grew so well and furnished such an attractive crop that in 1929 the entire wall was planted to strawberries.

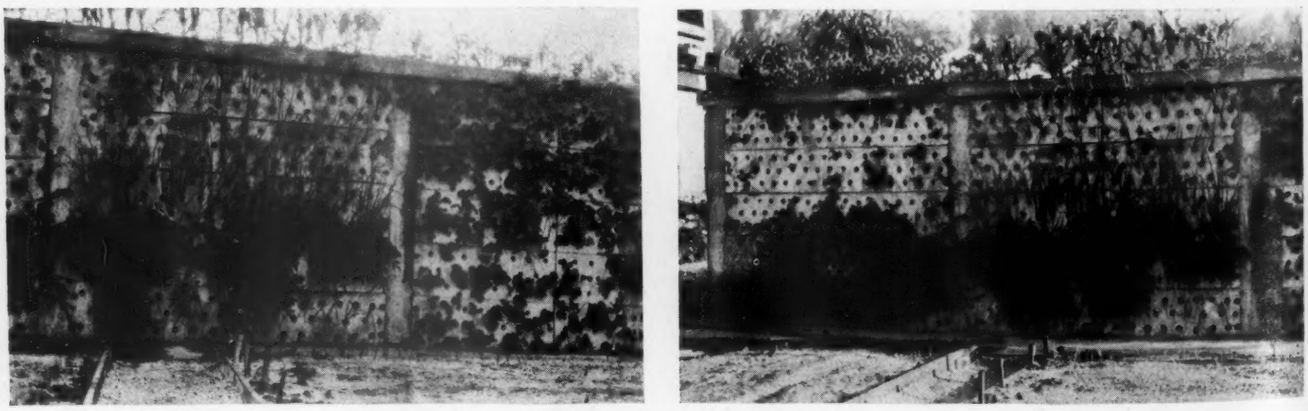
In 1930 the two right sections were planted to pansies and the left section to ferns, still without change of soil. These grew nicely for a time and then began to droop, showing the soil had soured. To correct this condition a nasturtium seed was planted in every alternate hole and the whole wall was soon a mass of bloom, the top in the meantime growing a crop of sunflowers which had a 6-ft. start of their ground-floor neighbors.

This year the soil has been entirely removed and replaced with new, containing plenty of leaf mold, and planted to the best variety of strawberries.

Central and Truck Mixed Concrete Studied by Road Builders

THE USE of central and truck mixed concrete in highway work is being studied by the American Road Builders' Association in cooperation with the National Ready Mixed Concrete Association.

With the organization of the National Ready Mixed Concrete Association, and in view of the active committee work being carried on by the American Concrete Institute and the American Society for Testing Materials, the American Road Builders' Association planned this year to turn over its data to these organizations and discontinue the committee. However, at their request and by agreement, the association is continuing its work this year on the use of central and truck mixed concrete.



Many varieties of vegetables and flowers have grown in this vertical garden

Lightweight Aggregates Progress

(By a Special Correspondent)

THE COMMERCIAL STATUS of lightweight aggregates changed only slightly during 1931, but increased interest has been evidenced in several ways. Professional societies and corporations are watching new developments and are examining critically the results already obtained.

At the 1931 meeting of the American Concrete Institute a special session was devoted to lightweight aggregates.[1] The Portland Cement Association is interested in their development, apparently in the belief that their wide use will expand the field of concrete construction. The American Institute of Mining and Metallurgical Engineers included lightweight aggregates on the program of its annual meeting,[2] and the subject has been discussed at other engineering gatherings.[3] The building materials section of the United States Bureau of Mines is making an economic study of all lightweight building materials related to the nonmetallic mineral industry. A research program on cinder concrete has been in progress at the United States Bureau of Standards, although it now is inactive. Numerous private testing laboratories are investigating potential additions to the group. Cement companies are showing considerable interest. All these indications point toward an ever-growing importance of the production and utilization of lightweight aggregates.

In as much as statistics showing the total production of either lightweight concrete or aggregates are not available, the ensuing discussion necessarily must be confined principally to generalities.

Cinders

The production of Straub cinder concrete units in 1931 undoubtedly will show some decline due to general conditions in the building industry. A preliminary estimate indicates that the total output will reach approximately 20,000,000 standard 8x8x16-in. units. This total is about one-third less than the peak production of a few years ago.

Among the outstanding buildings in 1931 in which cinder units were used are the Strawbridge and Clothier store and the Medical tower, Philadelphia, Penn.; the Claridge hotel, Atlantic City, N. J.; the Allegheny General hospital, Pittsburgh, Penn.; the Cornell University Medical Center, Ithaca, N. Y., and the United States post office, Roanoke, Va. Residences, apartments and office buildings are by far the most important outlets for cinder units.

A well planned educational program has resulted in a definite trend toward more careful selection of cinders for use as aggregate, which in turn is responsible for a general improvement in the resultant concrete. Unfortunately, the research program on cinder concrete which was being conducted at the Bureau of Standards was stopped late in the year. Its discontinuance is regrettable, because it unquestionably was one of the most valuable pieces of constructive scientific work ever attempted in the lightweight aggregates industry.

Enormous quantities of sand-cinder concrete continue to be used in building construction in the large eastern cities. New York City is referred to in a partially joking manner as the city built of cinders, and there is considerable truth in the statement, for it is estimated that more than 1,000,000 cu. yd. of the material is consumed there annually. Cinders were used extensively in the construction of the Empire State building, the magnitude of which is awe inspiring. The first building of the new Radio City group probably will require about 100,000 cu. yd. of sand-cinder concrete.

Rumors of special methods of preparing or reburning cinders were heard during the year, but nothing of any consequence was reported. Apparently no further work was done with Corlite, the aggregate made by adding a flux to anthracite ashes and sintering the mixture.

Natural Volcanic Rocks

Pumice and similar volcanic rocks were used locally during the year as concrete aggregate, but no plans for extensive development of any deposits have materialized. This activity is confined entirely to the western states. In Europe, especially in Italy and Germany, lightweight concrete made with pumice aggregate and with an artificial pumice is increasingly popular. The synthetic product apparently is similar to our burned shale aggregates.

Pottsco

"Pottsco" is still the only slag product which can be classed strictly as a lightweight aggregate. Its position was strengthened considerably by the issuance of a patent on August 4, 1931, covering the manufacturing process. Slag of course has been used as concrete aggregate for many years, but in applying for protection the attorneys took the position that Pottsco concrete was the first practical lightweight concrete made from any granulated slag aggregate. This claim apparently has been upheld by the Patent Office.

The manufacture of Pottsco is completed at the blast furnace. Molten slag is treated by a special process of water granulation. Production and utilization of the material are confined principally to the Chicago district, although a plant has been established near Pittsburgh. Practically all Pottsco is used in precast masonry units. The most noteworthy jobs in 1931 were the Catholic Monastery at Burlington, Wis., in which Pottsco back-up units were used; and a new city school at Muskegon, Mich., in which unplastered random ashlar units were used for interior gymnasium walls in addition to the standard units for back-up.

Waylite

Another process for preparation of a lightweight slag attracted attention during the year. Apparently it emanated from Germany, and it is reported that experiments relating to the manufacture of the material have been conducted in both the Chicago and the St. Louis districts. Nothing has been announced regarding the intentions of the investigators.

Samples of slag made by the process resemble Pottsco except that many of the fragments are considerably larger. The name "Waylite" has been given to the product, but this designation may be only temporary.

Burned Clay Aggregate

Haydite continues into 1932 as the sole occupant of the commercial field of burned shale aggregates, but developments during 1931 indicate that it soon will be joined by worthy competitive products.

After two years of research and development work the W. F. MacGlashan Associates have completed installation of a plant on the Pacific Coast to manufacture "Cel Sealed" aggregate, the product which was invented by Dr. Knox Harding.[4]

Little information has been published about the aggregate. The process consists of pugging ordinary clay or top soil, forcing it through dies and cutting it into lengths approximately equal to the diameter. These pellets are then coated with a refractory material, rounded by ball rolling machines, and charged into a rotary kiln fired by fuel oil, gas or powdered coal. The refractory coating forms an impervious layer on the surface of each cellular pellet. A similar effect is produced by special heat treatment.

The size, weight and strength of the aggregate are under complete control. The

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[1] Randall, F. A., Economics of Lightweight Concrete in Buildings: *Jour. Am. Concrete Inst.*, Vol. 2, No. 7, March, 1931, pp. 925-943. Christensen, Einar, Cinders as Concrete Aggregate: *Jour. Am. Concrete Inst.*, Vol. 2, No. 6, February, 1931, pp. 583-646. McIntyre, G. E., Burned Clay and Shale Aggregates.

[2] Hughes, H. H., Scope of the Lightweight Aggregates Industry: Am. Inst. Min. and Met. Eng., Tech. Pub. 405, 1931, 15 pp.

[3] Munsell, A. W., Lightweight Aggregate: *Engineers and Engineering*, Vol. 48, No. 9, 1931, pp. 210-215

sizes thus far produced range from less than ⅛-in. to more than 2-in. in diameter, and the weight ranges from about 14 to 35 lb. per cu. ft.

It is reported that three Los Angeles laboratories have been working independently in conducting tests of this aggregate and their results indicate that concrete weighing 90 lb. or less a cubic foot with a 28-day compressive strength of 2500 lb. may be made with it. Comparatively low water ratios are practicable, and the nature of the product is such that it lends itself admirably to optimum grading.

Judging from the evidence available at present, Cel Sealed aggregate should be well received by the construction industry. It is said that negotiations are now in progress with prospective associates for the establishment of Cel Sealed aggregate plants at strategic points in the East and Middle West.

Lytag

"Lytag" is the aggregate made by sintering a mixture of clay or shale and granulated fuel in a Dwight-Lloyd machine.[5] The process appears to be particularly adaptable for the utilization of carbonaceous shales similar to those commonly associated with the coal measures.

A license for the use of the Lytag patent recently has been executed under terms that obligate the licensee to construct and to have in operation in 1932 a large sintering plant for the manufacture of the aggregate. It is reported that present plans contemplate the temporary utilization of idle sintering equipment at a metallurgical plant, pending negotiations for more favorably located sites.

During 1931 one of the large anthracite producers carried on experiments with the Lytag process both on a laboratary scale and with full sized metallurgical equipment. Breaker waste was used without the addition of extra fuel, and the product was comparable to other aggregates in the lightweight group.

An Aggregate from Coal Breaker Waste

The Lehigh Navigation Coal Co. conceived the idea of burning breaker waste on a Coxe traveling grate, the resultant cinder being the primary product of the combustion process. Results to date indicate that the practice will be feasible commercially, and preliminary tests on concrete made from the aggregate indicate that it compares favorably in weight and strength with lightweight concrete now available.

Economically, the situation appears to be extraordinarily advantageous. The raw material will cost nothing, for the expense of conveying the waste from the breaker to a nearby plant no doubt will be less than that of transporting it to the present dumps. There will be no fuel costs; the breaker waste contains more than enough coal to carry on the process. In fact, enough by-product steam may be recovered to generate power for the plant.

Apparently no definite decision regarding commercial production has yet been made and exhaustive tests will be necessary to prove conclusively the worth of the aggregate, but judging from present evidence this unnamed product must be considered as a worthy potential member of the lightweight group.

Haydite

Commercial production of "Haydite" dates back to the World War when the forerunner of the modern product was used in the construction of concrete ships. The present process evolved from those humble beginnings.

Haydite is made by crushing non-refractory shale or clay to 1-in. or 1½-in. maximum and charging it into a rotary kiln about 50 ft. long. The material is preheated at the charging end, and then subjected to a temperature of more than 2000 deg. F. near the discharge end. This sudden increase causes rapid escape of the pent-up gases which in turn causes the individual particles to take on a vesicular structure. This resultant clinker is crushed and screened to three commercial sizes.[6]

Seven Plants Maintain Operation

No new Haydite kilns were added during 1931. Seven plants with a total of 14 kilns continued to operate throughout the year, but many were on a curtailed schedule due to the general slump in building construction. Total production of Haydite in 1931 has not been announced.

Business in the Kansas City district was comparatively good, but Haydite sales in Chicago, St. Louis, Cleveland and Buffalo reflected the general aspect of the building industry. Production at the Pittsburgh plant suffered because of a strike which tied up all major projects for several weeks. Toronto continued to be the bright spot of the Haydite industry, the plant at Cooksville, Ont., having been operated at nearly total capacity throughout the year. Plans have been formulated by the Canadian licensee to build a plant near Montreal, but construction has not yet been commenced.

The outstanding project completed in 1931 using Haydite concrete is the building of the Kansas City Power and Light Co. This magnificent structure certainly is one of the finest office buildings in the country, and its unusual engineering treatment depends partly on the use of lightweight concrete.

The present volume of production of lightweight aggregates is comparatively small, but the economic and scientific principles of lightweight concrete are fundamentally sound and a steady growth of the industry logically may be expected.

[4]Photographs of this product appeared in ROCK PRODUCTS, July 4, 1931, p. 77.

[5]The Dwight-Lloyd sintering machine was described in detail by Edward J. Tournier in *Iron Age*, January 19, February 16, March 8, 1928.

[6]A description of a typical Haydite plant appeared in ROCK PRODUCTS, July 4, 1931, p. 87.

Magnesite Brick

IN THE DECEMBER issue of *Mining and Metallurgy*, A. E. Fitzgerald, ceramic engineer, General Refractories Co., tells of some new developments in connection with the manufacture of unburned magnesite brick.

A brick press was built capable of forming brick under 10,000 lb. per sq. in. This pressure is ten times the pressure ordinarily used. The magnesite sand is graded so as to have a minimum of voids, which, with the aid of a colloidal lubricant, permits a brick to be fabricated that in use shows a lower shrinkage than the burned magnesite brick.

The unburned brick was subjected to rattler tests, crushing-strength tests, spalling, permeability to gases, and various other tests, and in all cases the new unburned brick showed superior qualities over the burned magnesite brick.

The fact that the new unburned magnesite brick has high resistance to vitrification and spalling suggests its use in the burning zones of rotary portland cement kilns. It was stated that mixtures of cement clinker and unburned magnesite brick were more refractory than clinker-high alumina mixtures.

Magnesite

FOLLOWING are statistics compiled by the Department of Commerce, Bureau of Mines, on domestic magnesite sold or treated in the United States for the years 1926-1930, inclusive:

Year	Short tons	Value
1926	133,500	$1,200,830
1927	121,490	1,090,550
1928	127,200	1,098,550
1929	187,660	1,500,000
1930	129,320	1,033,130

Cement Markets of British and Netherland Guiana

THE following table shows imports of cement in British Guiana during the last four years. Although complete figures for 1930 are not yet available, there is a general impression that Belgian cement increased in volume last year.

Source	1927 Barrels	1928 Barrels	1929 Barrels	1930 Barrels
United Kingdom	10,035	22,766	20,610	8,364
Canada	8,000	23,000	3,350	1,101
France	162	.....	957	8,258
Germany	606	100	52	
Belgium	1,752	5,416	5,364	
Netherlands	2,055	135	.....	
United States	.....	5	10	5
Total	22,610	51,422	30,343	17,728

All imports are of portland cement.

Local importers of cement favor American products, and introduction of American cement would depend mostly upon price.

No cement is produced in the Netherland Guiana colony. During 1929 imports of 100,717 bbl. of cement were received from the Netherlands, France, Germany and the United States.

There is no proposed construction that would affect the market for cement.

Northern Illinois Mineral Industries Conference

A MEETING of interest to rock products producers was held February 5, 1932, at the Kaskaskia hotel, LaSalle, Ill. This was a mineral industries conference held under the auspices of the Illinois Chamber of Commerce and the Illinois State Geological Survey in the interests of further development and utilization of the state's mineral resources. It was the second conference of the kind, the first having been held May 8, 1931, at Carbondale, Ill., and is part of a state-wide program to develop mineral resources. Some 150 were in attendance at the luncheon and the meeting following.

Wayne Hummer, LaSalle, Ill., chairman of the board of the Illinois Chamber of Commerce, who presided, spoke of the increased inflow of various mineral products from outside the state and the desirability of increasing production within the state.

Walter W. Williams, Benton, Ill., vice-president of the Chamber, in an introductory speech also brought out the importance of further development of the mineral resources of the state.

Charles M. Thompson, dean of the college of commerce, University of Illinois, Urbana, Ill., explained that the purpose of the present program is to locate new mineral resources and find new markets to offset the shrinkage in the value of mineral production over a period of years.

C. C. Whittier, consulting engineer, Robert W. Hunt Co., Chicago, Ill., read a paper on the trends in the construction industry resulting from research. He considered this a research age in which there is a constant search for new materials and new uses of them, and stated that the trend in construction is toward a greater use of mineral products and the elimination of fire losses and other wastes. He mentioned particularly the greater use of materials to insulate against noise, improved heating and ventilating methods, and predicted that more and more products manufactured from minerals will be used in the construction of the new type of modern homes and office buildings. He stated that the natural resources of the area have been only slightly developed.

Morris M. Leighton, chief of the State Geological Survey, Urbana, Ill., and chairman of the Mineral Industries Committee of the Illinois Chamber of Commerce, explained the part of the State Geological Survey in the new development program. He pointed out that this work has as its object the protection of present industries and the finding of new uses and stated that the plan is a worthy one since the mineral values of northern Illinois are greater than those of other so-called mineral states. The state has the second largest market in the country, but considerable limestone, sand and gravel and coal are now imported into the state.

The Survey plans to assist in this work by a study of the various minerals. Fundamental information on the composition of coals and the substances they come from is to be obtained and it is hoped to find other uses for them than as fuel. According to Dr. Leighton, new uses must be found for slack coal which amounts to 50% of the total produced and is now sold at a loss. X-ray studies are to be made to determine new qualities.

Dr. Leighton said that it was planned to have additional laboratories for this work; five chemical laboratories; one special laboratory for coal and fuels; one special laboratory for non-fuels; and an analytical laboratory, physical laboratory and industrial research laboratory. He stated that the facilities of the x-ray laboratory of the university had been made available for this work. These laboratories are not to be routine laboratories but will be in fields outside of the work of commercial laboratories. It is proposed to form a mineral economics section to gather and publsh timely figures on the production and consumption of mineral products in the state, which figures would be available much sooner than those contained in the Federal reports.

A paper by H. S. Ray, Rock Island lines, Chicago, gave figures on the rock products industries of northern Illinois, stating that the clay industry, the second largest, had a production value in 1929 of $25,000,000; cement, $11,000,000; limestone, $5,200,000; sand and gravel, $5,700,000; and silica sand, $2,500,000. He believed that statistics, such as proposed, on production, consumption and inflow from other states would be of great value and that materials within the state should be used so far as possible.

W. Y. Wildman, Illinois Coal Traffic Bureau, Chicago, Ill., gave interesting facts on the coal production of the state. He stated that coal was first discovered about 1668, or more than 263 years ago, between LaSalle and Ottawa.

This was previous to its discovery in Pennsylvania and other states.

Southern Illinois, according to Mr. Wildman, has the largest individual mines in the country. The peak production was in 1918, when approximately 90,000,000 tons were produced by 966 mines within the state, but this had fallen to 43,000,000 tons from 151 mines in 1931. He pointed out that part of this reduction has been due to more efficient burning methods, some 30% improvement in this way having been made during the past 10 years, to the greater use of electric energy produced from water power, and to the increased use of gas because of its convenience and cleanliness.

However, largely on account of high labor costs, which make up 80% of the total cost at the mines, and high freight rates, an increasing amount of coal from eastern states has been marketed in the state. He stated that while two-thirds of the state is underlaid with coal, and these deposits are estimated to comprise two hundred billion tons, less than 2% has been taken out.

Slate Association Elects Officers

THE RESULTS of the election held at the annual meeting of the National Slate Association have just been announced and are as follows: President, E. R. Norton, Norton Bros., Granville, N. Y.; vice-presidents, R. D. Chapman, Chapman Slate Co., Bethlehem, Penn.; W. A. Kitte, Natural Slate Blackboard Co., Pen Argyl, Penn.; Doster Focht, Vendor Slate Co., Easton, Penn.; Arthur Carpenter, Fair Haven, Marble and M. Slate Co., Fair Haven; W. A. LeSueur, Buckingham Virginia Slate Corp., Richmond, Va.; treasurer, R. B. Lewis, Phoenix Slate Co., Wind Gap, Penn. Directors—A. H. Morrow, Rising and Nelson Slate Co., West Pawlet, Va.; S. J. Spry, Colonial Slate Co., Bangor, Penn.; F. C. Sheldon, F. C. Sheldon Slate Co., Granville, N. Y.; Elwood Doney, Doney Slate Co., Pen Argyl, Penn.; John Williams, Buckingham-Virginia Slate Corp., Richmond, Va.; J. O'Brien, O'Brien Bros. Slate Co., Granville, N. Y.; W. H. Smith, North Bangor Slate Co., Bangor, Penn.; N. M. Male, Jackson Bangor Slate Co., Pen Argyl, Penn.; H. D. Hicks, Evergreen Slate Co., Granville, N. Y.; L. Renton Brown, Structural Slate Co., Pen Argyl, Penn.; Richard Jackson, Stephens Jackson Co., Pen Argyl, Penn.; and M. L. Parsons, Parsons Bros. Slate Co., Pen Argyl, Penn.

Treasurer R. B. Lewis is recovering from an illness in the Temple hospital at Philadelphia. A meeting of the new board of directors was held following the close of the regular sessions of the association and W. S. Hays, trade association executive, Philadelphia, was elected secretary and assistant treasurer.

Sales as estimated by the U. S. Bureau of Mines from reports received from quarrying companies for the year 1931, were valued at nearly $5,500,000. This was a decrease of 32% from the sales of 1930. However, total construction was off by nearly the same percentage so that the slate industry did not fare any worse than others depending for the major market upon building activities.

Saves Through Buying Cement in 1931

A SAVING of $160,000 has been accomplished through the purchase of Iowa primary highway cement November 24 instead of at a later date, a comparison of prices shows.

One million barrels of cement for the 1932 highway construction program was bought November 24. Since that time there has been an increase in the price, cement companies announced January 12.

An increase of 30c. in Kansas City was reflected in an increase of 16c. in Des Moines. On this basis the saving on the million barrels would be $160,000.—*Des Moines* (Ia.) *Tribune-Capital.*

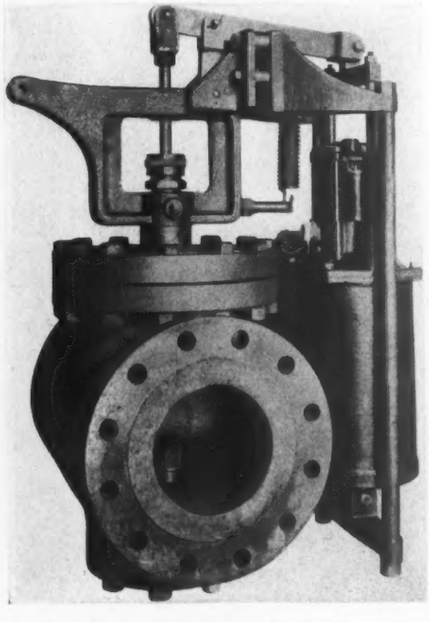
New Machinery and Equipment

Centralized Remote Control with New Valve

A NEW Thrustor-operated valve enabling centralized remote control of gases or liquids under pressure, is announced by the General Electric Co., Schenectady, N. Y. It is available in sizes ranging from 2 to 12 in. for from 125 to 600 lb. pressure per sq. in. and is designed for general applications, particularly where centralized remote control is desired. The new valve may also be installed in place of hand-operated valves.

In operation, the Thrustor, a self-contained power unit consisting of a motor controlling an improved hydraulic cylinder, applies pressure to the valve to open or close it. A spring is used to return the Thrustor to its original position.

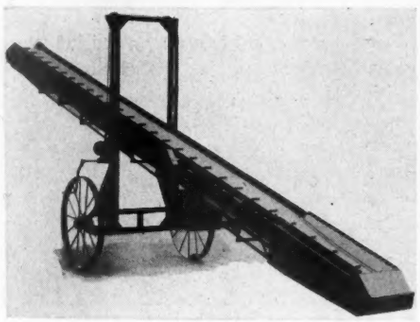
The Thrustor is adjustable for rapidly or slowly opening valves, the manufacturer states. The Thrustor type valve is positive in opening and closing, since it is direct-connected, and is said to require less time than a motor valve to operate. In addition, the manufacturer states, no overload protection is necessary in the motor circuit of the Thrustor, since the Thrustor can go to the extreme limit of its travel without overloading the motor. No limit switches are necessary for controlling the opening or closing of the valve. Because of the small amount of current consumed by the Thrustor motor, a small relay may be used to handle the unit.



Speed of operation adjustable and requires no overload protection

Portable Conveyor

A NEW LIGHT WEIGHT, all-purpose 14-in. portable belt conveyor which can be handled by one man, is announced by the Jeffrey Manufacturing Co., Columbus, Ohio.



Anti-friction bearings throughout

Anti-friction bearings are used throughout. Boom is of standard trussed construction. The upper chords of the truss also serve as skirtboards. A sheet metal cover return belt adds to the rigidity of the boom.

The boom is balanced on 42-in. by 3-in. roller bearing swivel wheels. Discharge height is regulated by a self-locking switch.

This machine is practical for unloading or reloading sand, gravel, cinders, crushed stone, coal and coke.

It is powered by either electric motor or gasoline engine; rated capacity, 50 tons per hr.

•

Scale Manufacturer Reorganizes

THE American Kron Scale Co., manufacturers of all types of heavy duty automatic dial scales, has recently been reorganized under the name of the Kron Co. The reorganization was decided upon to provide additional capital for use in broadening the lines of manufacture and increasing the activities of the company. The plant has been moved from its old location in New York City to Bridgeport, Conn., where larger and more adaptable space is available.

Richard F. Straw, associated with the Wright Manufacturing Co. since the war, has resigned his position as sales manager to become president of the new organization. The other officers are F. W. De Foe, vice-president, and H. C. Stevenson, secretary and treasurer. The board of directors consist of Ernst Ohnell, chairman; T. A. Yawkey, F. W. De Foe, Richard F. Straw and H. C. Stevenson.

George A. Nichols, New York manager of the Wright Manufacturing Co., has also resigned to become associated with the new company in an executive capacity.

Safety Gas Mask

E. D. BULLARD CO., San Francisco, Calif., announces the new Bullard gas mask for industrial use.

The Bullard gas mask is made with a one-piece molded face-piece, shaped to conform to any wearer's face. There are no splits or patches in the rubber which may tear or wear out. The face piece is held in place by light weight rubber straps which operate on a new principle of suspension. Instead of requiring tension which holds the face piece tightly against the face, the molded face-piece is suspended from the top of the head and held in place by straps which run around the head with a minimum tension.

Special construction of the castings connecting the face-piece with the flexible hose to the canistor is said to assure low breathing resistance.

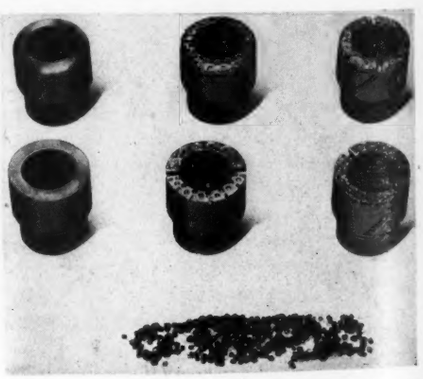
The gas mask face-piece is equipped with triangular eye pieces to give maximum horizontal and vertical vision. The eye pieces will positively not fog on the inside during inhalation or exhalation, the manufacturer states. Eye pieces are quickly removable and replaceable.

•

New Bit for Diamond Core Drills

A NEW SERVICE is announced by the Sullivan Machinery Co., Chicago, Ill. This service is the supplying of "Ready-set" bortz bits for the convenience of those who wish to avoid employing the services of a diamond setter or of carrying an excess stock of bortz. These bits are carried in standard sizes, the manufacturer states.

Two types of "Ready-set" bits are available: the ordinary or square shoulder and a new type round shoulder bit, which is claimed to drill many more feet than a square shoulder bit before resetting becomes



Round and square shouldered bits

necessary. It is also claimed that this shows approximately one-half as much bortz wear or bortz loss per foot of hole drilled as the square shoulder type. Round shoulder bits carry approximately 40% more stones by number and weight than square shoulder bits, the manufacturer states.

•

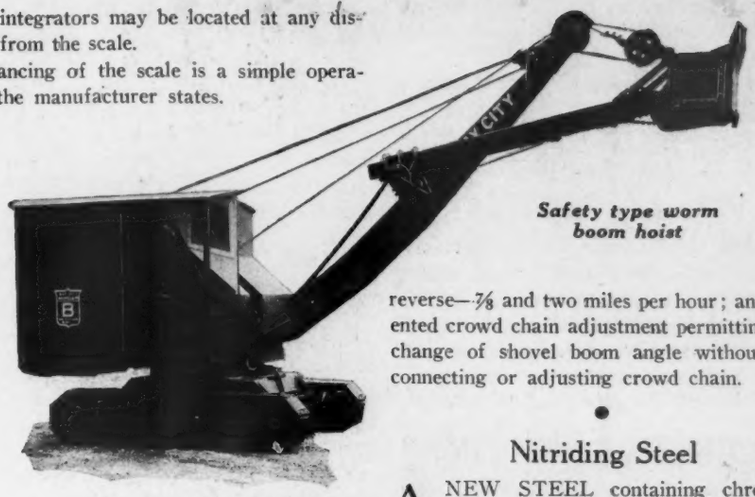
Weighing with Light

WEIGHING the flow of material on a conveyor belt; counting the tons that have been handled; and finally, recording on a time chart the belt loadings throughout the day, is the latest job undertaken by electric eye and ingenious electric brain. This application of the light-sensitive cell and electrical integrator or counter is announced by John Chatillon and Sons, New York, N. Y., and the Burgess Battery Co., New York, N. Y., who claim as advantages of this application, simplicity, lower cost and more positive adjustment. While the general scheme of weighing a continuous flow of material remains the same, the means whereby passing weights are converted into corresponding electrical impulses for the operation of the integrator, has been radically changed with the introduction of the light sensitive cell.

To obtain the weight of a continuous flow of material, it is necessary to combine the size of the stream with the speed at which it moves. This device provides that at the point where the continuous stream of material is to be weighed, a short section of belt is installed, mounted in such manner that its varying weight is communicated to the weight checking equipment placed directly above. With the varying weight of the load on the conveyor belt, the beam of the weight checking mechanism is actuated. The scale load at one end causes the fulcrumed beam to swing over the scale of the load indicator at the far or free end. This of course indicates the instantaneous weight, but there is still need for some device to keep tally of the continuous procession of varying weights. It is at this point that the electric eye gets to work.

By an ingenious application of light-sensitive cells the varying weight of material is registered. This registered weight is then integrated and recorded so that a continuous record may be had. One or more integrators and counters may be used in conjunction with each weighing device and these integrators may be located at any distance from the scale.

Balancing of the scale is a simple operation, the manufacturer states.



Safety type worm boom hoist

New Full Circle Shovel

BAY CITY SHOVELS, INC., Bay City, Mich., announces the Model B Bay City, a full revolving convertible shovel, crane and excavator with ⅜-cu. yd. bucket capacity with crane capacity of five tons. It is fully convertible to clamshell, dragline, skimmer and trench hoe.

The machine weighs 13½ tons equipped as a shovel. Standard shovel boom length is 15 ft., with optional 17-ft. boom if desired. It has a crane boom length of 30 to 35 ft.

The Bay City Model B in pattern and design is identical with the heavy duty Bay City ¾ and 1 yd. models. It is offered with optional McCormick-Deering 40 hp. power unit, or Hercules 4½-in. bore, 5¾-in. stroke. All Bay City features are built into this machine including chain crowd, unit cast car body, unit cast revolving machinery table, heavy duty patented swing lock, New Departure and Timken bearings on all machinery shafts, 7-in. center post and wide diameter swing circle.

Features which the manufacturer claims for this unit are compact machinery arrangement with drums in tandem on separate shafts; E-Z finger clutch control; machine cut gears throughout, cut from alloy steel blanks; boom foot located directly over table rollers on cast machinery table; safety type worm boom hoist; bucket with cast manganese front and back with reversible detachable teeth; two propelling speeds forward or reverse—⅞ and two miles per hour; and patented crowd chain adjustment permitting any change of shovel boom angle without disconnecting or adjusting crowd chain.

•

Nitriding Steel

A NEW STEEL containing chromium and vanadium has been developed by the Union Carbide and Carbon Research Laboratories, Inc. This steel is said to have many of the physical properties found in the S. A. E. 6100 series of steels. Chrome-vanadium nitriding steel contains from 0.50 to 2.50% chromium, from 0.30 to 2.00% vanadium, and from a very low percentage up to 0.70% carbon, depending upon the physical characteristics desired. It can be manufactured according to well-established plant technique, the laboratory reports.

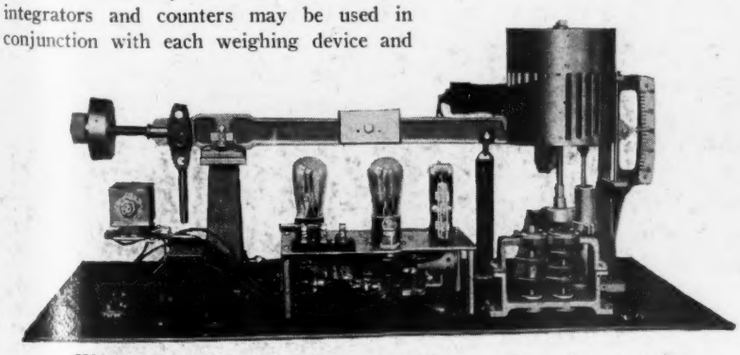
It is said chrome-vanadium nitriding steel has high strength, ductility and resistance to shock. Nitriding can be carried out at comparatively low temperatures, and hard, but ductile, case is said to be obtained.

•

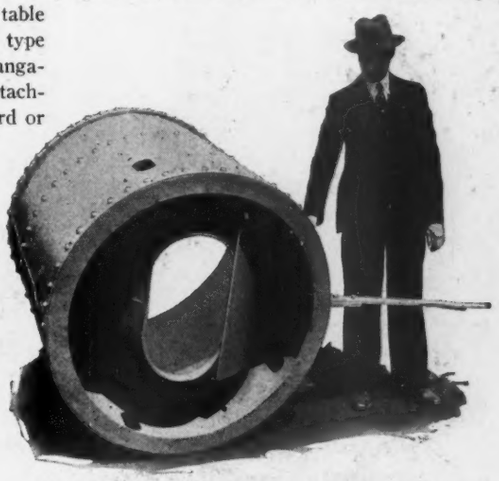
Acquires Rights to Concrete Bucket

THE Blaw-Knox Co., Pittsburgh, Penn., announces it has acquired exclusive manufacturing and sales rights of the Wiley concrete bucket, formerly manufactured and sold by the Dayton Whirley Co. This product will now be known as the Blaw-Knox concrete bucket.

These buckets are for derrick or cableway operation, but can also be used as floor hop-



Weighs and records weight of continuous flow of material



Concrete bucket for derrick or cableway operation

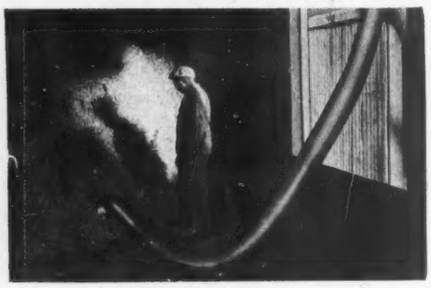
pers for loading buggies, wheelbarrows, or discharging into chutes, the manufacturer states.

These concrete buckets are made in three standard sizes—18, 33 and 63 cu. ft. capacities respectively.

•

Pneumatic Conveyor

A PNEUMATIC CONVEYOR is manufactured by the Brady Conveyor Corp., Chicago, Ill. It consists principally of an arrangement of closed metal pipes or ducts, a blower or exhauster, collectors, filters and feeding or discharging devices. Material is carried through the pipe or duct from receiving to delivery point by a current of air which the blower or exhauster creates.



Conveys granular bulk products

This equipment is said to have been successfully used in conveying lime, cement, slag, coal, ashes, sand, feldspar, kaolin, gypsum, rock wool, fuller's earth, soda ash and many other granular, bulk products.

The accompanying illustration shows this system being used in unloading a box car. Advantages claimed for this system are labor saving, small space requirements, eliminates dust and that it is self-cleaning.

•

Gear Reduction Unit

FOOTE Bros. Gear and Machine Co., Chicago, Ill., has announced an addition to its series of "Hygrade" worm gear speed reducers, designed to transmit up to 14 hp. continuous duty, this capacity depending on driving shaft speed and the reduction ratio.

Transmits up to 14 hp.

The new unit is designated size 5-HG and fills a gap between sizes 4-HG and 6-HG which in special cases could not be met economically by use of either of these last mentioned units. Like the other sizes in this line, the new reducer will be built in five types.

•

Polyphase Capacitor Motor

C. W. NOEL, consulting engineer, Ideal Electric and Manufacturing Co., Mansfield, Ohio, has devised a unique method of applying capacitors (condensers) to polyphase induction motors.

With the Noel method the condenser reactive current flows through the windings of the motor, which the manufacturer states produces a high power factor within the motor.

This scheme is said to give the Noel polyphase capacitor motor improved starting and running characteristics. The outstanding feature, the manufacturer states, is that it operates at practically unity (100%) power factor at all loads.

According to the manufacturer, several installations have already been made where the total cost of this motor and its capacitor was less than the cost of condensers alone to give the same amount of factor correction. It is claimed one of these motors will correct the power factor of two induction motors of similar size. Which means that with one of every three motors in a plant of this type a plant power factor of unity (100%) will be obtained.

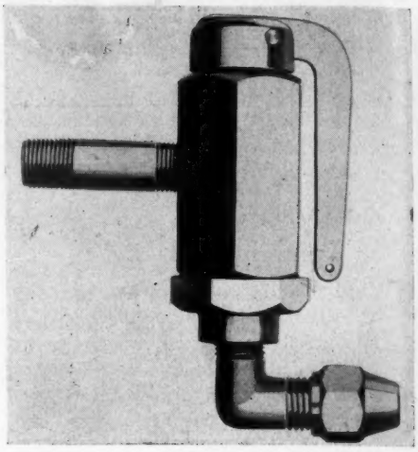
Has high power factor within motor

This new motor is built in various types to meet all starting torque and inrush classifications including across-the-line starting in all sizes and speeds up to 200 hp. at 80% leading or unity (100%) power factor.

•

Primer Facilitates Engine Starting

THE P-O-L PRIMER, a device for facilitating the starting of gasoline engines, has been introduced by the Linde Air Products Co., New York, N. Y. The P-O-L primer is a simple and easily installed device for introducing acetylene, a highly combustible gas, into the cylinders of an internal combustion engine so that it will start easily and quickly, the manufacturer states. It is said to provide a positive, safe and economical method of starting gasoline engines.



Makes gasoline engines start easier

The primer consists, essentially, of a special stem type brass primer valve, a Prest-O-Lite pressure regulator and 10 ft. of ¼-in. brass tubing with compression unions. The assembly is used in conjunction with the ordinary Prest-O-Lite tanks.

The P-O-L primer valve is mounted on the intake manifold of the engine, the regulator attached to the tank, and the two connected with ¼-in. brass tubing.

In starting an engine on which the P-O-L primer has been installed, the usual procedure of spark and gas adjustment is followed except that the P-O-L primer is used instead of the full choke.

This new device is said to be particularly useful in cold weather when gasoline engines are usually hard to start.

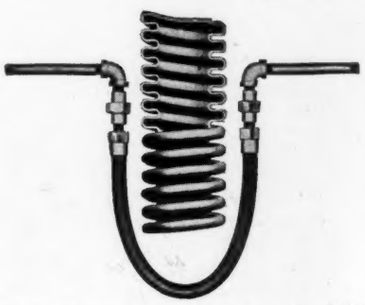
•

Flexible Tubing

A SEAMLESS, flexible metallic tubing has just been placed on the market by the Bendix Aviation Corp., South Bend, Ind.

The new product can be effective in any of these general applications: Fluid connections between moving parts, absorption of vibration and conveyance of liquids, semi-liquids, steam or gas.

The Bendix hose has been applied to such



Illustrating construction and flexibility

widely varied uses as lubrication, electric wiring conduits, automobile exhaust pipes, radiator hose, hydraulic and airbrake sytems and oil burners. It has withstood pressures of 10,000 lb. to the sq. in. and temperatures of over 500 deg., the manufacturer states.

Made of special bronze alloy seamless pipe, the Bendix hose is corrugated in round-thread single lead deep wall form and does not contain welded, brazed or interlocked joints.

A protective casing, braided from copper is designed to cover the hose with either one, two or three layers, depending on the pressure the hose must withstand. As a protection against mechanical damage to the braid covering and to distribute the flexing action, the manufacturer recommends use of an interlocked, unpacked galvanized steel casing over all.

The hose is being manufactured at present with internal diameters of $\frac{3}{16}$, $\frac{1}{4}$, $\frac{3}{8}$, $\frac{1}{2}$, $\frac{3}{4}$ and 1 in., but engineers declare it can be made in practically any size desired.

●

Elevator-Chisel Truck

THE Elwell-Parker Electric Co., Cleveland, Ohio, announces a 6000-lb. capacity machine with forks at the front end of an electric lift truck platform.

This truck is built to accommodate either a battery or gas-electric unit for power purposes.

The truck is driven by motor through worm and gear; all power transmission parts between motor and wheel are heat treated alloy steel, except the phosphor bronze worm wheel.

The forks are made in various lengths and with varying spreads to accommodate any material, or can be fitted with crane boom to handle motors and in assembly of machines; also to stack stock to great heights. After the forks are thrust under the load it may be tilted back 30 deg. in an inclined position to carry to destination, where load may be elevated 5 ft. for tiering.

When higher tiering is necessary the uprights are made longer so that the fork carriage which travels in it may rise to greater heights. Where headroom is restricted as in cars or through doorways and it is desired to tier loads to great heights later, telescoping uprights will be furnished.

The tilt and hoist features are accomplished by one unit. The lift is by cable, while the positive tilt is by rack and pinion drive. Likewise, the rack type provides for a positive forward tilt of uprights of several degrees. Automatic limit switches are used throughout.

This machine is the ninth of a series of fork trucks, and, in addition to having 6000 lb. capacity, retains all the flexibility of the 1000-lb. type, the manufacturer states.

Load may be tilted 30 deg. while traveling

●

Explosion Proof Motor Starter for Hazardous Locations

THE Electric Controller and Manufacturing Co., Cleveland, Ohio, announces a new motor starter known as the "No. 1 type ZEO across-the-line explosion-proof starter" which, the manufacturer states, has been officially approved by the Underwriters' for Class 1, Group D hazardous locations.

Enclosure is heavy enough to stand explosion

The contactor mechanism and overload relays are mounted on a slate base which is removable from the case. The main contacts and overload relay contacts are oil immersed and, according to the manufacturer, all working parts are kept well lubricated and protected from corrosion by capillary attraction of the oil.

The terminals are located above the level of the oil so that the oil will not cause deterioration of the insulation on the wires. It is said this design meets the Underwriters' requirements because the enclosure is heavy enough to withstand an explosion.

The maximum ratings of this starter are 5 hp., 110 volts and 10 hp., 220, 440 and 550 volts.

For controlling these starters the EC&M type EO explosion-proof push button may be used.

Buys Steel Division of H. D. Taylor and Co.

JOSEPH T. RYERSON & SON, INC., Chicago, Ill., announces it has purchased the stock and good will of the steel department of H. D. Taylor and Co., Buffalo, N. Y., effective January 15.

The stocks taken over by the Ryerson company include hot and cold rolled bars, shapes, plates, sheets, etc. The Ryerson company, specializing in the distribution of finished steel products for the past 90 years, has plants now established in Chicago, Milwaukee, St. Louis, Cincinnati, Detroit, Cleveland, Buffalo, Boston, Philadelphia, and Jersey City.

The Taylor company will continue to serve the trade through their enlarged hardware and mill supply divisions. They are also adding a general line of dry goods.

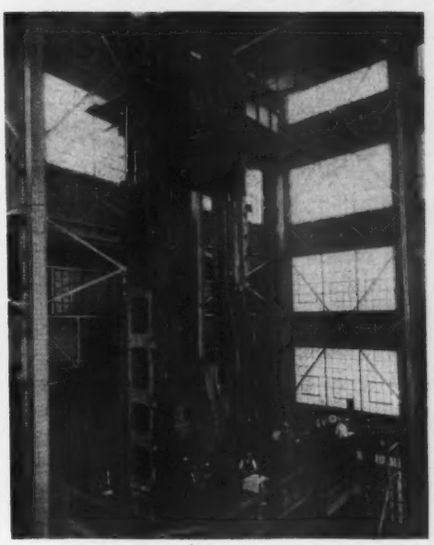
●

Builds Large Testing Machine

THERE has just been completed in and shipped from the shops of Baldwin-Southwark Corp., Eddystone, Penn., to the University of California at Berkeley, the largest testing machine in the world.

It is able to test columns up to 33 ft. 6 in. long in compression and up to 4,000,000 lb. load. In tension it accepts specimens up to 33 ft. 6 in. diminished by machine stroke and will apply loads up to 3,000,000 lb. The spread between the columns is 10 ft. and the table is 12 ft. long. Since the table is level with the laboratory floor a truck may drive between the columns and the specimen be lifted directly from the truck body by the testing machine itself.

Because the height of this machine above the floor is equivalent to more than that of the third floor of an average building provision has been made for the application of an elevator. This will permit the presence of assistants at any level for extensometer readings, or for inspection of the grips.



Tests columns 33 ft. 6 in. high

Exclusive Use of Name "Dry-Ice" Denied for Solid Carbon Dioxide

IN A DECISION handled down by the circuit court of appeals, New Orleans, La., January 8, 1932, hearing appeals and cross-appeals in the case of the DryIce Corp. of America, et al., vs. Louisiana Dry Ice Corp., et al., the opinion was given that the plaintiffs had no cause for action. The ruling of the court is abstracted below.

Two suits had been brought by DryIce Corp. of America and its licensee, DryIce Equipment Corp. (as plaintiffs), one, begun in January, 1930, in the federal court for the western district of Louisiana against the Louisiana Dry Ice Corp., and several individuals, and the other, begun in June, 1930, in the federal court for the northern district of Texas, against several individuals.

The first suit was brought to enjoin the use of the term or words "Dry-Ice" in the corporate title of the Louisiana Dry Ice Corp., or in connection with the sale of that corporation's stock or of solid carbon dioxide not produced by DryIce Corp. of America or its licensee.

The other suit was brought to enjoin the use by defendants therein of the term or words "Dry-Ice" in the corporate title of any corporation controlled by them, or in connection with the sale of stock or of solid carbon dioxide manufactured or to be manufactured by the defendants.

The bill in each case asserted claims based on three alleged United States trade marks issued to DryIce Corp. of America, one, No. 200,934, registered July 14, 1925, for the term or words "Dry-Ice" for carbon dioxide in solidified form; one, No. 215,799, registered July 27, 1926, for the same term or words for refrigerators, and one, No. 230,202, registered July 19, 1927, for the same term or words for empty containers adapted for use of carbon dioxide in solidified forms, mixtures or compounds.

Rulings of Courts on Validity of Mark

Each court ruled that the term "Dry-Ice" did not constitute a valid trade mark for solid carbon dioxide. The decree in each case adjudged that the use by the defendants of the words "Dry-Ice" tends to confuse and deceive the public into believing that the defendants are affiliated with the DryIce Corp. of America or the DryIce Equipment Corp. and constitutes a wrongful appropriation by the defendants of the good will and trade name property rights of the plaintiffs, and is unfair trading.

By each of the decrees the defendants in the suits were enjoined from using the words "Dry-Ice" unless accompanied by the distinguishing statement: "That this is not the original and pioneer DryIce Corp. of America, or its licensee"; and from using in selling the product the words, "Dry-Ice," unless accompanied by the distinguishing statement: "But this is not the original nor genuine 'Dry-Ice,' which is the solid carbon dioxide manufactured for many years by the pioneer DryIce Corp. of America, or its successors or licensees."

The decree in the Texas case adjudged that trade marks Nos. 215,799 and 230,202 are valid trade marks duly registered in the United States Patent Office, and enjoined their infringement by the defendants.

Circumstances in Sale of Refrigerant Cited

In 1924 the Prest-Air Corp., the predecessor of DryIce Corp. of America, began the manufacture and sale of solid carbon dioxide as a refrigerant. Before that time solid carbon dioxide was not in commercial use as a refrigerant. Solid carbon dioxide has a temperature of about 110 deg. below zero. When it "melts" it passes directly into a dry, gaseous state. These properties make it an excellent dry refrigerant for foodstuff, particularly for the shipment of ice cream.

In December, 1924, the Prest-Air Corp. adopted the word "DryIce" for its trade mark, and soon thereafter changed its corporate title to DryIce Corp. of America. By advertising throughout the country DryIce Corp. of America made known its use of the term "Dry-Ice" in its corporate name and to designate the solid carbon dioxide produced and marketed by it.

Its business rapidly increased, the quantities of solid carbon dioxide sold by it increasing from 295,800 lb. in 1925 to 27,376,000 in 1929. It attached to the product and equipment sold distinguishing labels embracing the term "Dry-Ice."

In October, 1929, the Louisiana Dry Ice Corp. was organized to produce solid carbon dioxide (otherwise known as "Quix Kold") for the isolation of inert gases, from natural gas, by the process commonly known as Belt Process, as a licensee of J. S. Belt Helium Interests, and to produce carbon dioxide gas for such purposes, with the ultimate results of producing what is known as Dry Ice, same to be known to the public as "Quix-Kold."

In this suit the following admissions were made: That defendants were aware of the claims of the plaintiff to the right to the exclusive use of the term "Dry-Ice" as plaintiff's trade name and trade mark two years prior to the institution of that suit, and knew that plaintiffs claim the right to the exclusive use of the term "Dry-Ice" as their trade mark and trade name, and that the term was registered in the United States Patent Office and in Texas, Louisiana and Colorado; that the defendants, since May, 1929, have used the term "Dry-Ice" indiscriminately in various states, and that the defendants, unless restrained by decree of the court, will continue to use the term "Dry-Ice" indiscriminately in referring to solid carbon dioxide produced by the defendants.

The plaintiffs appealed from the decrees in so far as they disallowed claims made by them. Defendants in each of the cases cross-appealed and complain of the decrees in so far as they awarded relief to the plaintiffs.

Under the Trade Mark Registration Act registration is not permitted of a mark which consists "merely in words or devices which are descriptive of the goods with which they are used, or of the character or quality of such goods." This provision forbids the use of a word or term as a trade mark which, though it does not accurately describe the article referred to by it, is descriptive of characteristics or qualities of that article.

Words Descriptive of Product Discussed

Under the quoted provision a word or collocation of words is not subject to registration as a trade mark if it is descriptive of a quality or characteristic of the article with which it is used, though part of it is the name of something else which merely is like or resembles that article, the two things not being identical; as the word Rubberoid, used as the name of a product which contains no rubber but has qualities possessed by rubber.

The term "Dry-Ice"—being a combination of the descriptive adjective "dry" and the noun "ice" (water in its solid or frozen state)—when used with solid carbon dioxide, is descriptive in that that article in appearance somewhat resembles ice, as does snow when compressed into a solid mass and frozen, and possesses qualities or characteristics of ice in having a temperature much below zero and in being serviceable as a refrigerant, but has a characteristic distinguishing it from ice in that by heat it is dissolved into dry gas instead of into water.

That word or term, being descriptive of characteristics or qualities of the article with reference to which it was used, was not subject to be registered as a trade mark for that article.

False Representation in Use of Marks

The term "Dry-Ice," being descriptive of qualities or characteristics of solid carbon dioxide, the product with reference to which it was used, the plaintiffs had no right to prevent the defendants or any of them from using that term in corporate names or in designating solid carbon dioxide produced or to be produced and marketed by them, if the latter's so doing was unaccompanied by any wrongful conduct having the effect of falsely

representing the origin or source of their product or attempting to palm it off on the purchasing public as the product of the plaintiffs.

It is only when the adoption or imitation of what is claimed to be a trade mark amounts to a false representation that there is any title to relief against it. True, it may be that the use by a second producer, in describing his product, of a name or a combination of words already in use by another, may have the effect of causing the public to mistake as to the origin or ownership of the product, but if it is just as true in its application to his goods as it is to those of another who first applied it, and who, therefore, claims an exclusive right to use it, there is no legal or moral wrong done. Purchasers may be mistaken, but they are not deceived by false representations, and equity will not enjoin against telling the truth.

Defendants did not become chargeable with fraud or misrepresentation by merely using the term "Dry-Ice" in corporate names or in referring to solid carbon dioxide they were planning to produce, though at that time that term had acquired what is called a secondary meaning by reason of it becoming associated in the minds of members of the public with the product of a particular manufacturer.

Where no exclusive right to the use of a word or term exists, a charge of fraud or misrepresentation—unfair competition—in the use of it by another cannot be sustained unless it is supported by proof.

When the two suits were brought none of the defendants therein was or had been engaged in the production or sale of solid carbon dioxide, but they were preparing to engage in that business, had used the term "Dry-Ice" in corporate names adopted by them or at their instance, and had manifested a purpose to use that term in referring to the solid carbon dioxide to be produced and marketed by them or their licensees. There was no evidence tending to prove that the defendants contemplated or had threatened to do anything amounting to unfair competition, or to wrongfully or fraudulently misleading or deceiving anyone as to the source or origin of their product.

Nothing in the evidence indicated that they intended to use in connection with the solid carbon dioxide to be produced by them or their licensees any mark or label having any resemblance to a mark or label used on a product of the plaintiffs. The evidence failed to show that the defendants had done or intended to do any wrongful act with the intention of bringing about or facilitating the substitution of their product with purchasers who wanted a product of the plaintiffs and supposed that was what they were getting. Evidence introduced by the plaintiffs tended to prove that before the defendants were active in preparing to enter the field the catchy descriptiveness of the term "Dry-Ice" as applied to solid carbon dioxide as a refrigerant had resulted in an extensive adoption of that term as the nontechnical name of that article; testimony of customers of the plaintiffs indicating that to them that term meant solid carbon dioxide, whether it was or was not a product of the plaintiffs or their licensee.

One of those witnesses testified that "Dry-Ice" is a good name for solid carbon dioxide and describes that article. A witness for the plaintiffs who was an official of both of them testified that solid carbon dioxide was often referred to as "Dry-Ice" by uninformed persons irrespective of its origin. The evidence as to the way the plaintiffs conducted the business of selling or marketing their products indicated a lack of probability of any purchasers or prospective purchasers being defrauded by being induced to buy the product of a defendant when the product of a plaintiff was desired.

Evidence showed that products of the plaintiffs were sold in their own containers, marked with identifying labels. No evidence showed that any of the solid carbon dioxide produced by the plaintiffs had ever come, or was likely to come, to the possession of a purchaser of it otherwise than in a container having on it plaintiffs' label or identifying mark. No evidence indicated that the product of the plaintiffs had been or would be sold otherwise than to direct purchasers and in containers so marked as to indicate the source of the contents. It cannot reasonably be inferred that such a purchaser, intending to get plaintiffs' product, would buy solid carbon dioxide from a manufacturer or dealer who claimed no connection with the plaintiffs, unless the product was offered in the trade dress customarily used by the plaintiffs for their products or wrongful deception in some other way was practiced.

Conclusions of the Court

"We conclude that the evidence failed to show that the defendants had done, or had planned, or threatened to do, anything amounting to unfair competition or to a wrong against the plaintiffs, giving rise to a cause of action in favor of the latter.

"The evidence did not show that the defendants had planned or threatened to sell or deal in refrigerators or empty containers, to use the term 'Dry-Ice' with reference to those things, or to do anything having the effect of challenging claims of the plaintiffs based on the purported registered trade marks numbered 215799 and 230202. Such being the state of the evidence, it furnished no basis or support for an injunction restraining the doing by the defendants of what, so far as appears, they never intended to do.

"The evidence failing to show an actual or threatened commission by the defendants of a wrong against which the plaintiffs were entitled to protection by injunction, the decrees appealed from were erroneous in so far as they awarded relief in favor of the plaintiffs. The plaintiffs take nothing on their appeals. On the cross-appeals of defendants those decrees are reversed."

New Use for Stone

A RADIO built within a cabinet of Indiana limestone has been completed by Joseph Houston, of Bloomington, Ind.

The cabinet weighs 400 lb. It was made without cement or fastenings of any kind. Each part was carefully measured before being cut so that the entire cabinet fits together firmly, but can be disassembled for moving. Hand carved panels add an artistic touch.

Mr. Houston said that the limestone gives the radio a tone lacking in cabinets of other materials.—*Lorain* (Ohio) *Times-Herald.*

Census of Manufactures

THE CENSUS BUREAU is now mailing its 1931 Census of Manufactures questionnaires to all manufacturers, requesting that they be filled out and returned promptly.

The 1931 questionnaire is considerably smaller than the one used for the 1929 canvass. The major items covered are:

Wage earners employed, by months.
Wages paid.
Cost of materials, fuel, and purchased electric energy.
Products by quantity and value.

Falling Stone Kills Quarry Worker

WILLIAM BLOOMFIELD, 20, of Birmingham, Mo., was killed instantly on December 30 while working in a rock quarry southeast of Columbia. A piece of limestone weighing about 65 lb. fell 8 ft., crushing him beneath it.

The accident happened at night, while Mr. Bloomfield and a fellow employe were drilling in preparation for blasting operations. The rock was dislodged by the vibration set up by the drilling and fell without warning. —*Columbia* (Mo.) *Missourian.*

Find New Silica Deposits in Illinois

DEPOSITS of silica in Reynolds township south and east of Ashton, Ill., have been reported, following the operations of geologists who spent several weeks excavating and drilling on farms, it became known recently.

In Reynolds township it is reported that the geologists found silica sand in generous deposits along a creek bed and it is thought to have been present in quantities sufficient to make profitable the mining of sand.—*Dixon* (Ill.) *Telegram.*

Great Lakes Limestone Tonnage

IN THE ANNUAL REPORT of the Lake Carriers Association, Joseph S. Wood, president, will give 74,148,865 net tons as the total bulk freight commerce of the Great Lakes in 1931, a drop of 24.1% from the 1930 tonnage. Of this 7,208,946 net tons was limestone.

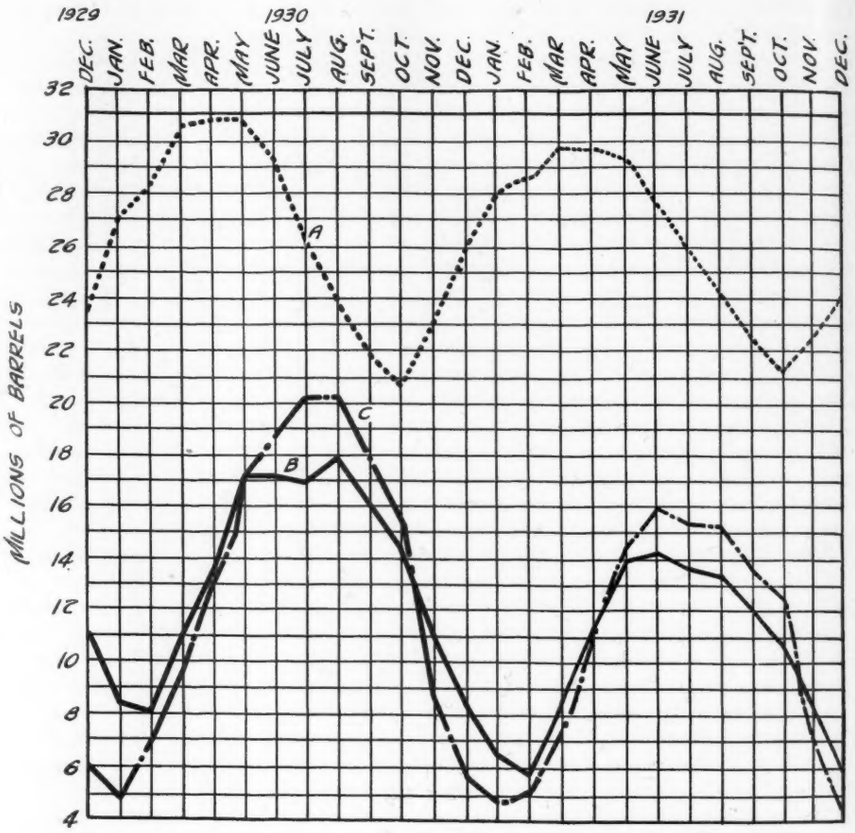
Portland Cement in December—and Preliminary Totals for the Year

THE PORTLAND CEMENT INDUSTRY in December, 1931, produced 5,998,000 bbl., shipped 4,142,000 bbl. from the mills, and had in stock at the end of the month 24,075,000 bbl. Production of portland cement in December, 1931, showed a decrease of 29.3% and shipments a decrease of 27.2% as compared with December, 1930. Portland cement stocks at the mills were 6.8% lower than a year ago. The preliminary totals for 1931 show decreases of 22.7% in production and 20.5% in shipments from the final totals for 1930 as given in the accompanying figures. Shipments from mills in 1931 amounted to 126,465,000 bbl., with an estimated factory value of $139,381,000. The statistics here presented are compiled from reports for December, received by the Bureau of Mines, from all manufacturing plants except three, for which estimates have been included in lieu of actual returns.

In the following statement of relation of production to capacity the total output of finished cement is compared with the estimated capacity of 165 plants both at the close of December, 1931, and of December, 1930. The estimates include increased capacity due to extensions and improvements during the period.

RELATION OF PRODUCTION TO CAPACITY

	Dec. 1930 Pct.	Dec. 1931 Pct.	Nov. 1931 Pct.	Oct. 1931 Pct.	Sept. 1931 Pct.
The month	38.2	26.4	37.2	47.4	55.3
12 months ended	61.5	46.5	44.4	48.6	50.2


1929
1930
1931
DEC. JAN. FEB. MAR APR. MAY JUNE JULY AUG. SEPT. OCT. NOV. DEC. JAN. FEB. MAR APR. MAY JUNE JULY AUG. SEPT. OCT. NOV. DEC.
MILLIONS OF BARRELS
32 30 28 26 24 22 20 18 16 14 12 10 8 6 4
A
B
C

(A) Stocks of finished portland cement at factories; (B) Production of finished portland cement; (C) Shipments of finished portland cement from factories

Distribution of Cement

The following figures show shipments from portland cement mills distributed among the states to which cement was shipped during October and November, 1930 and 1931.

PORTLAND CEMENT SHIPPED FROM MILLS INTO STATES IN OCTOBER AND NOVEMBER, 1930 AND 1931, IN BARRELS*

Shipped to	1930—October	1931—October	1930—November	1931—November
Alabama	88,358	50,940	67,219	26,734
Alaska	697	808	158	1,639
Arizona	33,524	27,780	31,593	17,011
Arkansas	144,307	40,635	89,411	34,693
California	931,721	580,258	†665,028	470,754
Colorado	78,683	86,048	41,748	38,404
Connecticut	153,822	162,540	113,957	115,800
Delaware	20,017	27,187	17,889	18,229
District of Columbia	154,670	122,498	84,931	95,710
Florida	89,354	51,252	74,271	37,769
Georgia	174,340	162,410	103,952	128,392
Hawaii	23,850	21,468	17,979	21,519
Idaho	34,385	15,481	13,538	9,077
Illinois	1,586,016	856,580	655,302	406,836
Indiana	321,285	313,599	160,458	138,043
Iowa	317,288	209,676	98,047	75,393
Kansas	226,472	166,235	153,458	85,981
Kentucky	223,805	149,282	102,299	90,891
Louisiana	172,194	485,188	133,845	260,677
Maine	87,454	46,894	53,127	24,292
Maryland	257,617	291,938	119,436	198,975
Massachusetts	376,533	344,866	248,481	230,690
Michigan	867,458	461,985	407,866	191,760
Minnesota	237,592	242,908	89,729	91,214
Mississippi	39,377	23,656	34,044	15,557
Missouri	713,573	481,965	413,025	213,618
Montana	27,189	21,927	20,597	9,559
Nebraska	174,005	194,514	68,717	51,826
Nevada	18,751	18,440	6,681	14,780
New Hampshire	48,117	51,874	24,958	30,307
New Jersey	664,381	645,068	403,664	398,550
New Mexico	27,047	25,380	17,445	11,949
New York	2,063,858	2,096,119	1,233,534	1,227,819
North Carolina	101,403	59,103	63,911	55,078
North Dakota	24,513	17,110	7,734	6,173
Ohio	1,011,292	749,570	614,013	372,879
Oklahoma	270,430	174,121	195,644	124,304
Oregon	130,953	91,480	87,098	52,811
Pennsylvania	1,351,511	781,503	517,568	528,285
Porto Rico	5,000	4,515	125	9,270
Rhode Island	76,031	54,139	34,865	35,781
South Carolina	273,208	243,408	177,632	166,201
South Dakota	44,410	29,736	17,948	14,229
Tennessee	271,922	111,024	117,871	95,367
Texas	438,457	542,920	454,199	369,500
Utah	38,549	22,669	21,142	12,905
Vermont	53,087	32,942	21,939	15,769
Virginia	155,410	122,618	102,029	117,236
Washington	324,276	157,064	262,159	71,393
West Virginia	139,483	142,876	105,304	83,551
Wisconsin	414,797	389,339	157,633	153,691
Wyoming	20,691	10,638	8,763	4,908
Unspecified	40,039	121,253	13,633	53,609
	15,563,202	12,335,427	†8,747,597	7,127,388
Foreign countries	35,798	24,573	†36,403	28,612
Total shipped from cement plants	15,599,000	12,360,000	8,784,000	7,156,000

*Includes estimated distribution of shipments from three plants in October and November, 1931; from two plants in October and November, 1930.
†Revised.

SUMMARY OF MONTHLY ESTIMATES OF PRODUCTION AND SHIPMENTS OF FINISHED PORTLAND CEMENT, WITH ESTIMATED VALUE OF SHIPMENTS IN 1931, BY DISTRICTS

(Quantities in thousands of barrels)

(Revised January 13, 1932)

District	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	1931	1930	
Production															
Eastern Penn., New Jersey and Maryland	1,617	1,630	2,293	2,691	3,053	2,900	2,675	2,891	2,761	2,369	2,046	1,434	28,360	35,141	
New York and Maine	420	151	437	832	1,106	1,230	1,192	1,375	1,292	1,110	686	458	10,289	11,342	
Ohio, Western Pennsylvania, West Virginia	504	412	444	829	1,289	1,505	1,520	1,296	1,063	904	769	422	10,957	17,620	
Michigan	45	109	72	524	722	919	983	832	743	602	385	197	6,133	11,511	
Wisconsin, Illinois, Indiana and Kentucky	804	427	797	1,231	1,913	1,757	1,877	1,818	1,623	1,337	894	707	15,185	20,233	
Virginia, Tenn., Alabama, Georgia, Fla., La.	646	836	942	1,268	1,418	1,312	1,319	1,193	1,069	1,009	733	596	12,341	12,881	
East'n Missouri, Iowa, Minn., South Dakota	854	766	869	1,261	1,335	1,300	1,414	1,449	1,228	975	827	600	12,878	16,694	
West'n Missouri, Nebr., Kan., Okla., Ark.	450	263	638	674	1,248	1,187	1,015	987	701	795	566	688	9,212	12,510	
Texas	322	286	489	585	600	634	646	644	625	601	459	291	6,182	6,781	
Colorado, Montana, Utah, Wyoming, Idaho	123	160	192	233	296	298	219	209	171	117	97	59	2,174	2,269	
California	624	709	830	793	703	745	670	552	529	698	555	474	7,882	10,124	
Oregon and Washington	186	171	242	324	327	331	369	303	287	245	144	72	3,001	4,091	
	6,595	5,920	8,245	11,245	14,010	14,118	13,899	13,549	12,092	10,762	8,161	5,998	124,594	161,197	
Shipments															**Estimated value of shipments, 1931**
Eastern Penn., New Jersey and Maryland	1,084	1,123	1,724	2,587	2,952	3,260	3,114	3,147	3,108	3,123	2,064	1,310	28,596	35,357	$29,725,000
New York and Maine	206	182	381	769	1,137	1,360	1,436	1,556	1,500	1,231	661	321	10,740	11,122	11,939,000
Ohio, Western Pennsylvania, West Virginia	367	415	595	919	1,252	1,507	1,471	1,353	1,224	1,139	581	282	11,105	17,068	10,823,000
Michigan	220	219	286	529	825	1,030	1,147	1,065	807	616	267	153	7,164	10,818	7,461,000
Wisconsin, Illinois, Indiana and Kentucky	354	416	526	1,260	1,743	2,220	2,275	2,316	1,995	1,662	761	375	15,903	19,572	14,599,000
Virginia, Tenn., Alabama, Georgia, Fla., La.	679	768	1,061	1,343	1,428	1,463	1,210	1,082	1,032	1,050	763	432	12,311	12,729	15,310,000
East'n Missouri, Iowa, Minn., South Dakota	288	377	494	1,029	1,538	1,917	1,896	1,737	1,341	995	474	212	12,298	16,886	11,941,000
West'n Missouri, Nebr., Kan., Okla., Ark.	321	404	520	942	1,307	1,303	1,102	1,121	886	881	475	372	9,634	11,880	9,430,000
Texas	340	328	456	581	644	693	696	667	688	583	378	214	6,268	6,792	8,868,000
Colorado, Montana, Utah, Wyoming, Idaho	50	82	126	184	298	278	229	232	224	185	85	43	2,016	2,375	3,374,000
California	643	602	770	733	710	737	624	595	593	662	527	370	7,566	10,439	11,357,000
Oregon and Washington	140	158	253	308	366	309	345	301	273	233	120	58	2,864	4,021	4,554,000
	4,692	5,074	7,192	11,184	14,200	16,077	15,545	15,172	13,671	12,360	7,156	4,142	126,465	159,059	$139,381,000

SUMMARY OF ESTIMATES OF STOCKS OF FINISHED PORTLAND CEMENT AT END OF EACH MONTH IN 1931, BY DISTRICTS

(Quantities in thousands of barrels)

(Revised January 13, 1932)

District	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Eastern Pennsylvania, New Jersey and Maryland	5,546	6,054	6,622	6,725	6,824	6,465	6,026	5,769	5,422	4,668	4,649	4,774
New York and Maine	1,988	1,957	2,013	2,076	2,044	1,914	1,669	1,489	1,281	1,159	1,185	1,321
Ohio, Western Pennsylvania and West Virginia	3,709	3,705	3,565	3,476	3,513	3,511	3,559	3,505	3,344	3,122	3,310	3,450
Michigan	2,915	2,814	2,600	2,586	2,482	2,372	2,208	1,975	1,908	1,893	2,011	2,054
Wisconsin, Illinois, Indiana and Kentucky	3,955	3,966	4,237	4,208	4,378	3,915	3,518	3,020	2,648	2,352	2,485	2,817
Virginia, Tennessee, Alabama, Georgia, Florida and Louisiana	1,766	1,833	1,714	1,639	1,630	1,479	1,576	1,687	1,725	1,684	1,656	1,821
Eastern Missouri, Iowa, Minnesota and South Dakota	3,069	3,458	3,833	4,064	3,862	3,244	2,762	2,474	2,361	2,372	2,710	3,098
Western Missouri, Nebraska, Kansas, Oklahoma and Arkansas	2,218	2,077	2,196	1,885	1,826	1,710	1,624	1,490	1,305	1,219	1,311	1,626
Texas	782	740	773	777	734	675	626	603	539	558	649	726
Colorado, Montana, Utah, Wyoming and Idaho	410	486	552	600	609	629	609	585	541	474	485	501
California	831	938	998	1,110	1,103	1,113	1,158	1,114	1,050	1,086	1,114	1,218
Oregon and Washington	570	584	573	569	549	575	599	602	612	631	654	669
	27,759	28,612	29,676	29,715	29,554	27,602	25,934	24,313	22,736	21,218	22,219	24,075

SUMMARY OF MONTHLY ESTIMATES OF CLINKER (UNGROUND PORTLAND CEMENT) PRODUCED AND IN STOCK AT MILLS IN THE UNITED STATES IN 1931, BY DISTRICTS

(Quantities in thousands of barrels)

(Revised January 13, 1932)

District	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	1931	1930
Production														
Eastern Pennsylvania, New Jersey and Maryland	1,878	1,947	2,489	2,699	3,004	2,660	2,537	2,514	2,417	2,089	1,922	1,622	27,778	34,318
New York and Maine	659	326	669	979	1,028	1,021	1,047	1,019	987	992	750	585	10,062	11,237
Ohio, Western Pennsylvania and West Virginia	724	580	623	897	1,188	1,271	1,339	1,123	822	741	747	480	10,535	17,443
Michigan	445	380	382	486	577	623	610	587	464	615	338	314	5,821	11,678
Wisconsin, Illinois, Indiana and Kentucky	1,000	891	980	1,419	1,685	1,533	1,574	1,479	1,276	1,140	1,047	735	14,759	20,405
Virginia, Tennessee, Alabama, Georgia, Florida, Louisiana	587	749	962	1,238	1,283	1,274	1,281	1,218	1,078	877	746	653	11,946	13,188
Eastern Missouri, Iowa, Minnesota and South Dakota	898	896	1,137	1,256	1,318	1,145	1,159	1,302	1,168	924	798	621	12,622	16,536
Western Missouri, Nebraska, Kansas, Oklahoma, Arkansas	550	388	716	648	1,125	1,143	935	817	691	814	578	725	9,130	12,872
Texas	315	292	430	565	496	702	675	633	576	583	479	339	6,085	6,548
Colorado, Montana, Utah, Wyoming and Idaho	128	160	203	234	312	297	212	181	109	59	58	98	2,051	2,284
California	686	706	813	835	800	754	588	503	502	686	609	589	8,071	10,519
Oregon and Washington	259	158	182	284	343	256	289	288	324	305	187	79	2,954	3,964
	8,129	7,473	9,586	11,540	13,159	12,679	12,246	11,664	10,414	9,825	8,259	6,840	121,814	160,992
Stocks (end of month)														
Eastern Pennsylvania, New Jersey and Maryland	1,329	1,665	1,893	1,934	1,923	1,731	1,593	1,237	936	688	601	799	.....	.....
New York and Maine	902	1,078	1,314	1,470	1,403	1,212	940	600	315	209	276	406	.....	.....
Ohio, Western Pennsylvania and West Virginia	1,290	1,464	1,645	1,710	1,634	1,402	1,262	1,100	868	702	708	769	.....	.....
Michigan	1,271	1,542	1,852	1,820	1,679	1,415	1,049	823	555	571	524	641	.....	.....
Wisconsin, Illinois, Indiana and Kentucky	1,091	1,558	1,741	1,928	1,706	1,490	1,199	871	532	311	464	495	.....	.....
Virginia, Tennessee, Alabama, Georgia, Florida, Louisiana	966	872	897	865	737	709	685	715	720	597	611	671	.....	.....
Eastern Missouri, Iowa, Minnesota and South Dakota	584	727	1,006	1,021	1,027	930	710	587	545	478	462	471	.....	.....
Western Missouri, Nebraska, Kansas, Oklahoma, Arkansas	666	791	871	848	732	695	622	461	456	479	495	537	.....	.....
Texas	339	348	300	288	193	270	310	310	274	266	289	341	.....	.....
Colorado, Montana, Utah, Wyoming and Idaho	276	276	287	286	280	280	285	258	187	127	88	128	.....	.....
California	1,175	1,141	1,085	1,294	1,362	1,364	1,290	1,252	1,230	1,235	1,292	1,411	.....	.....
Oregon and Washington	495	484	427	390	411	339	264	254	300	358	405	412	.....	.....
	10,384	11,946	13,318	13,854	13,087	11,837	10,209	8,468	6,918	6,021	6,215	7,081	.....	.....

PRODUCTION AND STOCKS OF CLINKER BY MONTHS, IN 1930 AND 1931, IN BARRELS

Month	1930—Production—1931		Stocks at end of month 1930	Stocks at end of month 1931	Month	1930—Production—1931		Stocks at end of month 1930	Stocks at end of month 1931
January	10,504,000	8,129,000	9,646,000	10,384,000	July	15,069,000	12,246,000	11,684,000	10,209,000
February	10,008,000	7,473,000	11,572,000	11,946,000	August	15,244,000	11,664,000	9,275,000	8,468,000
March	13,045,000	9,586,000	13,503,000	13,318,000	September	14,577,000	10,414,000	7,783,000	6,918,000
April	15,025,000	11,540,000	15,164,000	13,854,000	October	13,895,000	9,825,000	7,266,000	6,021,000
May	16,607,000	13,159,000	14,668,000	13,087,000	November	11,639,000	8,259,000	7,758,000	*6,215,000
June	15,895,000	12,679,000	13,452,000	11,837,000	December	9,484,000	6,840,000	8,809,000	7,081,000

PRODUCTION, SHIPMENTS AND STOCKS OF FINISHED PORTLAND CEMENT, BY DISTRICTS, IN DECEMBER, 1930 AND 1931, AND STOCKS IN NOVEMBER, 1931, IN BARRELS

District	Production 1930	Production Dec. 1931	Shipments 1930	Shipments Dec. 1931	Stocks at end of month 1930	Stocks at end of month 1931	Stocks at end of Nov., 1931*
Eastern Penn., N. J., Md.	1,939,000	1,434,000	1,469,000	1,310,000	5,036,000	4,774,000	4,649,000
New York and Maine	716,000	458,000	364,000	321,000	1,774,000	1,321,000	1,185,000
Ohio, Western Penn., W. Va.	769,000	422,000	467,000	282,000	3,587,000	3,450,000	3,310,000
Michigan	614,000	197,000	245,000	153,000	3,096,000	2,054,000	2,011,000
Wis., Ill., Ind. and Ky.	984,000	707,000	394,000	375,000	3,604,000	2,817,000	2,485,000
Va., Tenn., Ala., Ga., Fla., La.	680,000	596,000	648,000	432,000	1,795,000	1,821,000	1,656,000
East'n Mo., Ia., Minn., S.D.	906,000	600,000	337,000	212,000	2,403,000	3,098,000	2,710,000
West'n Mo., Nebraska, Kansas, Oklahoma and Arkansas	700,000	688,000	367,000	372,000	2,089,000	1,626,000	1,311,000
Texas	392,000	291,000	362,000	214,000	802,000	726,000	649,000
Colo., Mont., Utah, Wyo., Ida.	34,000	59,000	46,000	43,000	353,000	501,000	485,000
California	531,000	474,000	755,000	370,000	763,000	1,218,000	1,114,000
Oregon and Washington	215,000	72,000	234,000	58,000	536,000	669,000	654,000
	8,480,000	5,998,000	5,688,000	4,142,000	25,838,000	24,075,000	22,219,000

PRODUCTION, SHIPMENTS AND STOCKS OF FINISHED PORTLAND CEMENT, BY MONTHS, IN 1930 AND 1931, IN BARRELS

Month	1930—Production	1931	1930—Shipments	1931	Stocks at end of month 1930	1931
January	8,498,000	6,595,000	4,955,000	4,692,000	27,081,000	27,759,000
February	8,162,000	5,920,000	7,012,000	5,074,000	28,249,000	28,612,000
March	11,225,000	8,245,000	8,826,000	7,192,000	30,648,000	29,676,000
April	13,521,000	11,245,000	13,340,000	11,184,000	30,867,000	29,715,000
May	17,249,000	14,010,000	17,224,000	14,200,000	30,891,000	29,554,000
June	17,239,000	14,118,000	18,781,000	16,077,000	29,364,000	27,602,000
July	17,078,000	13,899,000	20,153,000	15,545,000	26,289,000	25,934,000
August	17,821,000	13,549,000	20,299,000	15,172,000	23,824,000	24,313,000
September	16,124,000	12,092,000	18,083,000	13,671,000	21,889,000	22,736,000
October	14,410,000	10,762,000	15,599,000	12,360,000	20,697,000	21,218,000
November	11,098,000	8,161,000	8,784,000	7,156,000	23,056,000	*22,219,000
December	8,480,000	5,998,000	5,688,000	4,142,000	25,838,000	24,075,000
	160,905,000	124,594,000	158,744,000	126,465,000	.....	.....

PRODUCTION AND STOCKS OF CLINKER (UNGROUND CEMENT) BY DISTRICTS, IN DECEMBER, 1930 AND 1931, IN BARRELS

District	1930—Production	1931	Stocks at end of month 1930	1931
Eastern Pennsylvania, New Jersey and Maryland	2,052,000	1,622,000	1,045,000	799,000
New York and Maine	817,000	585,000	659,000	406,000
Ohio, Western Pennsylvania and West Virginia	992,000	480,000	1,064,000	769,000
Michigan	690,000	314,000	871,000	641,000
Wisconsin, Illinois, Indiana and Kentucky	1,109,000	735,000	887,000	495,000
Virginia, Tennessee, Alabama, Georgia, Florida, Louisiana	745,000	653,000	1,028,000	671,000
Eastern Missouri, Iowa, Minnesota and South Dakota	950,000	621,000	530,000	471,000
Western Missouri, Nebraska, Kansas, Oklahoma, Arkansas	807,000	725,000	556,000	537,000
Texas	393,000	339,000	338,000	341,000
Colorado, Montana, Utah, Wyoming and Idaho	0	98,000	271,000	128,000
California	607,000	589,000	1,140,000	1,411,000
Oregon and Washington	322,000	79,000	420,000	412,000
	9,484,000	6,840,000	8,809,000	7,081,000

EXPORTS AND IMPORTS OF HYDRAULIC CEMENT, BY MONTHS, IN 1930 AND 1931

Month	1930—Exports Barrels	1930—Exports Value	1931—Exports Barrels	1931—Exports Value	1930—Imports Barrels	1930—Imports Value	1931‡—Imports Barrels	1931‡—Imports Value
January	82,387	$293,135	41,199	$115,678	201,609	$207,461	97,057	$132,937
February	64,267	217,798	25,703	88,989	114,455	119,717	22,370	26,250
March	117,563	357,896	54,599	144,579	43,622	59,981	70,532	80,686
April	57,419	200,217	40,478	116,564	140,871	178,226	54,717	61,728
May	57,423	198,170	48,028	140,953	94,696	111,998	20,061	22,794
June	82,077	223,639	43,619	107,977	55,356	74,370	32,080	42,955
July	47,082	166,577	29,494	97,995	12,404	20,973	17,445	22,349
August	49,031	167,579	39,517	106,643	35,323	39,029	9,760	13,404
September	46,664	153,384	27,543	81,399	51,096	59,721	33,575	33,520
October	62,690	190,305	24,531	68,524	75,284	84,364	39,642	42,380
November	50,495	151,555	33,200	97,796	109,124	125,448	27,940	22,235
December	38,680	134,260	.....	.....	44,157	59,641	.....	.....
	755,778	$2,454,515	.....	.....	977,997	$1,140,929	.....	.....

*Revised. ‡Includes white nonstaining portland cement.

Exports and Imports†*

Compiled from the records of the Bureau of Foreign and Domestic Commerce and subject to revision.

EXPORTS OF HYDRAULIC CEMENT BY COUNTRIES IN NOVEMBER, 1931

Exported to	Barrels	Value
Canada	1,370	$ 5,031
Central America	14,728	37,645
Cuba	2,400	4,359
Other West Indies and Bermuda	817	1,450
Mexico	3,420	10,738
South America	9,259	32,483
Other countries	1,206	6,090
	33,200	$97,796

IMPORTS OF HYDRAULIC CEMENT BY COUNTRIES AND BY DISTRICTS, IN NOVEMBER, 1931

Imported from	District into which imported	Barrels	Value
Belgium	Porto Rico	2,127	$ 1,829
Canada	Maine and N. H.	9	33
Cuba	Porto Rico	604	900
Denmark	Porto Rico	2,504	2,250
Japan	Hawaii	1,696	1,546
United K'g'd'm.	New York	21,000	15,677
		27,940	$22,235

DOMESTIC HYDRAULIC CEMENT SHIPPED TO ALASKA, HAWAII AND PORTO RICO IN NOVEMBER, 1931

	Barrels	Value
Alaska	510	$ 1,213
Hawaii	19,224	47,467
Porto Rico	9,515	12,738
	29,249	$61,418

*The value of exports of domestic cement is the actual cost at the time of exportation in the ports of the United States whence they are exported, as declared by the shippers on the export declarations.

†The value of imported cement represents the foreign market value at the time of exportation to the United States.

State Quits Buying Cement Direct for Road Work

THE 1932 policy of the Oklahoma state highway commission will be one of small lettings every week with contractors furnishing their own cement on paving jobs.

The chairman's statement foreshadowed complete abandonment of the policy of buying cement in 1,000,000 bbl. lots by the state and a return to the old system of allowing contractors to buy their own cement and include the cost in their paving bids.—*Oklahoma City* (Okla.) *Times*.

RETAIL MATERIAL PRICES, DELIVERED, JANUARY 1, 1932 (COMPILED BY DEPARTMENT OF COMMERCE)

City	Portland cement, per bbl., exclu. of cont.	Gypsum wallboard, ⅜-in., per M	Hydrated lime, per ton	Building sand, per cu. yd.	Crushed stone, ¾-in., per ton	Gypsum plaster, neat, per ton
New Haven, Conn.	$2.90	.....	$20.00	$1.25	$2.25	.....
New London, Conn.	2.60	25.00	18.00	1.50	3.00	$18.00
Waterbury, Conn.	2.60	30.00	20.00	1.25	2.45	20.00
Haverhill, Mass.	2.32	25.00	18.00	.....	.....	18.50
Albany, N. Y.	2.34	23.85	15.75	.....	.....	16.20
Buffalo, N. Y.	2.95	21.00	18.00	2.50	2.05	16.00
Poughkeepsie, N. Y.	1.95	.....	.....	2.25	2.20	13.00
Rochester, N. Y.	2.28	22.00	20.00	2.25	2.40	16.00
Syracuse, N. Y.	2.60	20.00	.....	1.80	1.60	14.00
Paterson, N. J.	2.20	24.00	18.00	1.50	2.10	17.50
Trenton, N. J.	2.10	23.00	18.00	.90	1.05	17.00
Erie, Penn.	2.10	22.50	16.00	2.00	.....	16.00
Philadelphia, Penn.	2.10	.....	13.73	1.75	2.60	17.50
Scranton, Penn.	2.40	.....	20.00	4.39	.....	19.90
Baltimore, Md.	2.10	25.00	13.00	1.85	2.50	15.50
Washington, D. C.	1.65	25.00	12.00	.....	.....	14.00
Richmond, Va.	2.90	.....	21.00	1.65	2.10	18.00
Fairmont, W. Va.	2.75	35.00	16.00	2.80	3.50	18.00
Columbia, S. C.	2.28	35.00	.....	1.50	2.60	15.40
Atlanta, Ga.	2.50	.....	15.00	2.81	2.50	19.75
Savannah, Ga.	2.35	27.50	21.50	1.75	3.50	16.50
Tampa, Fla.	2.60	.....	24.00	2.75	2.80	.....
New Orleans, La.	2.35	.....	14.00	1.85	.....	18.00
Shreveport, La.	3.00	38.00	.....	2.00	3.20	20.00
Akron, Ohio	$1.74	.....	$12.00	$1.50	$2.50	$14.00
Cincinnati, Ohio	1.94	22.75	14.40	2.63	2.55	.....
Cleveland, Ohio	2.00	22.00	10.00	1.69	2.15	15.00
Columbus, Ohio	2.35	.....	12.00	1.50	2.75	14.40
Toledo, Ohio	1.40	21.00	12.00	1.60	1.75	14.00
Youngstown, Ohio	2.43	23.25	16.00	2.50	2.50	18.00
Detroit, Mich.	2.00	25.00	12.00	2.03	1.75	15.00
Lansing, Mich.	2.25	.....	.....	1.80	1.80	17.50
Saginaw, Mich.	1.85	25.00	16.00	2.25	2.20	18.00
Terre Haute, Ind.	2.00	28.00	18.00	1.25	3.00	18.00
Chicago, Ill.	1.55	20.00	12.50	1.75	2.00	14.00
Louisville, Ky.	1.86	.....	15.00	2.00	2.15	17.00
Milwaukee, Wis.	1.25	22.00	14.00	1.25	1.25	15.20
Des Moines, Iowa	1.82	23.50	18.00	1.40	4.15	14.00
Kansas City, Mo.	2.08	25.00	22.00	1.65	2.25	15.00
St. Louis, Mo.	2.00	.....	16.00	1.35	1.65	16.00
St. Paul, Minn.	2.15	21.00	19.00	1.25	1.75	17.00
Grand Forks, N. D.	2.60	.....	16.25	2.60	.....	18.75
Sioux Falls, S. D.	2.00	40.00	22.00	1.25	2.00	15.00
Tulsa, Okla.	1.90	22.50	22.50	.85	2.35	16.00
San Antonio, Tex.	2.42	42.00	20.00	2.15	2.35	17.00
Tucson, Ariz.	3.49	45.00	30.00	1.25	2.25	17.10
Los Angeles, Calif.	2.30	23.50	24.70	1.85	1.90	15.20
San Francisco, Calif.	2.54	45.00	22.50	1.40	1.40	17.30
Seattle, Wash.	2.40	35.00	22.00	1.40	1.50	18.00

The Rock Products Market

Wholesale Prices of Aggregates

(F.O.B. Plant or City Designated)

Prices given are for crushed limestone per ton, unless otherwise stated

	Crushed stone			Gravel,	Slag	
	Screenings, ¼ in. down	½ in. and less to 2½ in.	Sand ¼ in. and less	½ in. and less to 2 in.	Screenings, ¼ in. down	Crushed, ½ in. and less to 3 in. and larger
EASTERN:						
Alexander, N. Y.			.65d	.65d		
Bethlehem, Penn.					.50– .60	.50–1.00r
Boston, Mass. (g)			1.15	1.75		
Buffalo, N. Y.	1.25¶	1.25¶	1.00–1.10d	1.00–1.10d	1.50d	1.50–1.60d
Clarence, N. Y.			.60v	.60v		
Hillsville, Penn.	.85	1.35				
Montoursville, Penn.			.75	.60		
New York City			1.00	1.50		
Oriskany Falls, N. Y.	.50–1.00	.80–1.00	.50– .75	.50–1.00		
Philadelphia, Penn. (trap rock)	2.16–3.51	2.36	1.55	2.05		
Port Jefferson, N. Y.			.50*	1.25*		
Rochester, N. Y.			1.40	1.40		
Washington, D. C.			.85	1.30		
CENTRAL:						
Alton, Ill.	1.75	1.75				
Chicago, Ill.			.95	1.00		
Davenport, Iowa	1.00	1.25				
Eau Claire, Wis.			.30– .40	.75– .85		
Greenbush, Mich.			.35	.65		
Indianapolis, Ind.			.40– .50d	.50– .60d		
McCook, Ill.	.60	.60				
Milwaukee, Wis.	1.28	1.38	.90x	1.05x		
Riverton, Ind.			.40– .60	.60– .75		
Stone City, Iowa	.75	1.00				
St. Louis and Maplewood, Mo.	1.25	1.25	.70	1.00–1.10		
Toledo, Ohio	1.16	1.66			1.10	1.20
Waukesha, Wis.		.90	.45	.60		
Wyoming and Grandville, Mich.			.30	.60		
SOUTHERN:						
Atlanta, Ga. (granite)	1.10	1.50				
Atlas, Ky.	.50–1.00	.90–1.00				
Birmingham and Woodward, Ala.					.55‡	.90–1.25‡
Cartersville, Ga.	.90	.80				
Chico, Tex.	.50	1.10–1.30				
(Trap rock)	2.25	1.10				
Columbia, S. C. (granite)	.50	1.40				
Ensley, Ala.					.80	.80–2.05u
Fort Springs, W. Va.	.35	1.00–1.25				1.00
Fort Worth, Tex.			.75	1.00		
Houston, Tex.			1.25*	1.95k		
Knoxville, Tenn.	.50	1.00	.60– .75	.60–1.00		
Longdale, Va.					.75	1.05–1.25
Montgomery, Ala.			.25– .35	.50– .60		
Roseland, La.			.40	.75		
San Antonio, Tex.	1.50w	1.50w				
Tyrone, Ky.	.50– .90	.50–1.25				
WESTERN:						
Crushton, Calif. (San Gabriel Valley) (granite)	1.40	1.40	.80	1.40		
Denver, Colo. (h)			1.15*	1.75*		
Long Beach, Calif. (Granite and trap rock)	2.40	2.40	1.50	2.40		
Phoenix, Ariz. (n)			1.65	1.50		
Roscoe, Calif. (San Fernando Valley) (granite)	1.40	1.40	.80	1.40		
Salt Lake City, Utah			.60	.60		
San Francisco, Calif. (Bay points)			1.45	1.45		
Seattle, Wash.			1.25*	1.25*	1.25	1.25
Tulsa, Okla.	.70s	1.35s				

*Prices per cu. yd. ¶F.o.b. cars. †Less 10c per ton monthly settlements disc. ‡Prices less 5c disc. per ton for payment 15th following month. (a) Consumer prices subject to cash disc. of 10c per ton. (b) ½ in. to 1½ in. (c) 1½ in. and less. (d) F.o.b. trucks at plant. (e) Delivered in truck loads. (f) ¾ in. to 2½ in. (g) Delivered to job by truck, Boston. (h) Pea gravel, per cu .yd., 1.15. (k) Less 10c cash disc. (m) 2 in. and less. (n) Per cu. yd. in city limits. (p) Hard-head stone. (q) ¾ in. to 2½ in. (r) Crushed slag, ½ in., 90c–1.00; ¾ in., 50c–60c; 1½ in., 60c–70c; 2½ in., 60c–80c. (s) Less 15c per ton for cash 10 days. (t) Delivered on job. (u) F.o.b. plant. (v) F.o.b. cars or trucks. (w) F.o.b. job, San Antonio. Also $1.25 f.o.b. cars. (x) Also 1.00–1.40 per cu. yd.

Agricultural Limestone

(Crushed)

Alco, Va.—Analysis, 97% $CaCO_3$; 1% $MgCO_3$; 50% thru 100 mesh, per ton	2.25
Alton, Ill.—90% thru 100 mesh	4.50
Branchton, Penn.—100% thru 20 mesh, 60% thru 100 mesh, 45% thru 200 mesh, all per ton	*4.50
Cartersville, Ga.—Pulverized limestone, per ton, 1.75; 90% thru 50 mesh, per ton	1.50
Chico, Tex.—Pulverized limestone, in 100-lb. bags, per cwt.	1.00
Colton, Calif.—Analysis, 95.97% $CaCO_3$; 1.31% $MgCO_3$ all thru 14 mesh down to powder	3.50
Davenport, Iowa — Analysis, 90-98% $CaCO_3$; 2% and less $MgCO_3$; 90% thru 4 mesh; bulk	1.00
Dolomite, Calif.—Analysis, 54% $CaCO_3$; 45% $MgCO_3$; 99% thru 10 mesh, per ton, 2.10; 49% thru 60 mesh, ¼-in. to dust, per ton	**1.70**
Dubuque, Ia.—Analysis, 64.04% $CaCO_3$; 29.54% $MgCO_3$; 50% thru 100 mesh, per ton	1.00
Fort Spring, W. Va.—Analysis, 90% $CaCO_3$; 3% $MgCO_3$; 50% thru 100 mesh, per ton, bulk, 1.15; in 80-lb. bags	2.75
Gibsonburg, Ohio—99% thru 10 mesh, 60% thru 100 mesh; in bags, per ton, 3.50; in bulk, per ton	2.50
Agricultural meal, 100% thru ⅜-in. mesh screen, 25% thru 100 mesh screen, ton	1.00
Hillsville, Penn.—Pulverized limestone, per ton	3.00–4.50
Knoxville, Tenn.—80% thru 100 mesh, per ton	2.00
Lannon, Wis.—50% thru 100 mesh	1.50
Marion, Va.—Analysis, 80% $CaCO_3$; 20% $MgCO_3$; per ton	1.00
Marlbrook, Va.—Analysis, 95% $CaCO_3$, 50% thru 100 mesh; per ton, in bulk, 2.25; in bags	3.25
McCook, Ill.—Analysis, 55% $CaCO_3$; 45% $MgCO_3$, 90% thru 50 mesh, 50% thru 50 mesh, 90% thru 4 mesh, 50% thru 4 mesh, all per ton	.60
Middlebury, Vt.—Analysis, 99.05% $CaCO_3$; 90% thru 50 mesh	**4.25**
Osborne, Penn.—50% thru 100 mesh, per ton	2.50–4.00
Stone City, Ia.—Analysis, 98% $CaCO_3$; 50% thru 50 mesh	**.75**
Waukesha, Wis.—50% thru 100 mesh, per ton	2.10
West Rutland, Vt.—Analysis, 96.5% $CaCO_3$; 1% $MgCO_3$; 50% thru 100 mesh, in 80-lb. bags, per ton	3.75

*Less 50c commission.

Pulverized Limestone for Coal Operators

Davenport, Ia.—Analysis, 90-98% $CaCO_3$; 2% and less $MgCO_3$; 100% thru 20 mesh, 50% thru 200 mesh; sacks, ton	6.00
Joliet, Ill.—Analysis, 48% $CaCO_3$; 42% $MgCO_3$; 90% thru 200 mesh (bags extra)	3.50
Waukesha, Wis.—90% thru 100 mesh	4.10

Masonry Cement

Packed in paper sacks. Prices, f.o.b. cities named, include cost of sacks.

	Per bag	Per bbl.
Chicago, Ill.	.46¾	1.87
Cincinnati, Ohio	.44	1.76
Cleveland, Ohio	.47¼	1.89
Columbus, Ohio	.46	1.84
Dayton, Ohio	.44¾	1.79
Detroit, Mich.	.47¼	1.89
Indianapolis, Ind.	.43	1.72
Louisville, Ky.	.41	1.64
Memphis, Tenn.	.49¼	1.97
St. Louis, Mo.	.46¼	1.85
Toledo, Ohio	.46¾	1.87

Mica

Prices given net, f.o.b. plant or shipping point.

Martinsville, Va.—Mica schist, per ton	10.00
Penland, N. C.—Mine scrap, per ton, 15.00; clean shop scrap, 18.00; roofing mica, per ton	25.00
Franklin, N. C.	
Mine scrap, per ton	18.00
Ground mica, per ton at mill, 20 mesh, 27.50; 40 mesh, 30.00; 100 mesh	50.00
Wet ground mica, per lb., delivered	.05
Punch, per lb.	.06

Roofing Slag

Prices given are per ton f.o.b. city named.

Bethlehem, Penn.	1.00–1.50‡
Buffalo, N. Y.	2.50†
Ensley and Alabama City, Ala.	2.05
Longdale, Va.	2.50
Toledo, Ohio	1.20¶
Woodward, Ala.	2.05*

*Less 5c ton disc. for pay. 15th following month.

†Price f.o.b. trucks at plant, subject to discount of 10c per ton for payment on or before the 15th of following month. ‡F.o.b. plant. ¶F.o.b. trucks, slag plant.

Portland Cement

	F.o.b. city named Per Bag	Per Bbl.	High Early Strength
Albuquerque, N. M.	.....	2.63	.....
Atlanta, Ga.	.....	†1.90	2.95¶
Birmingham, Ala.	.....	1.58†	2.63¶
Boston, Mass.	.44½	1.78†	2.52¶
Charleston, S. C.	.....	1.93†	2.98¶
Cheyenne, Wyo.	.....	2.06	.....
Chicago, Ill.	.....	1.35†	2.00¶
Cincinnati, Ohio	.....	1.42†	2.07¶
Cleveland, Ohio	.....	.....	2.08¶
Columbus, Ohio	.....	.....	2.07¶
Dallas, Tex.	.....	1.81	2.86¶
Dayton, Ohio	.....	.....	1.93¶
Denver, Colo.	.....	2.00	.....
Detroit, Mich.	.....	1.47†	2.12¶
Houston, Tex.	.....	2.03	3.08¶
Indianapolis, Ind.	.....	1.41†	2.06¶
Jackson, Miss.	.....	1.98†	3.03¶
Jacksonville, Fla.	.....	2.00†	3.05¶
Kansas City, Mo.	.25½	1.02†	.....
Los Angeles, Calif.	.57½	2.30	.....
Louisville, Ky.	.....	1.45†	2.10¶
Memphis, Tenn.	.....	1.77†	2.82¶
Milwaukee, Wis.	.....	1.45†	2.04¶
Montreal, Que.	.....	1.66§	.....
New Orleans, La.	.....	1.86†	2.96¶
New York, N. Y.	.37¼	1.49†	2.28¶
Oklahoma City, Okla.	.38½	1.54†	.....
Omaha, Neb.	.34	1.36†	.....
Portland, Ore.	.....	2.40‡	.....
Reno, Nev.	.....	2.76‡	.....
St. Louis, Mo.	.....	1.37†	2.02¶
San Francisco, Calif.	.....	2.04‡	.....
Savannah, Ga.	.....	1.93†	2.98¶
Seattle, Wash.	.....	2.30–2.55	3.00c
Tampa, Fla.	.....	2.00†	3.16¶
Toledo, Ohio	.....	.....	2.02¶
Topeka, Kan.	.30¾	1.21†	.....
Tulsa, Okla.	.36½	1.46†	.....
Mill prices f.o.b. in carload lots, without bags, to contractors.			
Hudson, N. Y.	.....	*1.21–‖1.36†	‖2.33¶
Lime & Oswego, Ore.	.....	2.40	.....
Limedale, Ind.	.....	1.10†	.....

NOTE: Unless otherwise noted, prices quoted are net prices, without charge for bags. Add 40c per bbl. for bags. †Includes 10c cash disc. ‡Subject to 2% discount payment 10th of month following invoice date. ¶"Incor" Perfected, prices per bbl. packed in paper sacks, subject to 10c discount 15 days. (c) Quick-hardening "Velo," packed in paper bags, 10c discount 10 days. §Sales tax included at 4%. *F.o.b. cars. ‖Trucks, mill.

Special Aggregates

Prices are per ton f.o.b. quarry or nearest shipping point.

City or shipping point	Terrazzo	Stucco-chips
Brandon, Vt.—English pink, cream and coral pink	¶12.50–‖14.50	¶12.50–‖14.50
Cardiff, Md. — Crushed green marble (a)	¶12.50–‖14.50	¶12.50–‖14.50
Cranberry Creek, N. Y.	.....	‖12.00
Los Angeles, Calif.—(a)		
White	¶11.00–‖13.50	¶11.00–‖13.50
Snowflake	.....	¶11.00–‖13.50
Golden, browns, grey, blues, blacks	¶16.00–‖18.50	¶16.00 ‖18.50
Dolomite, Calif. (Lone Pine)—(a)		
White	¶8.80– ‖8.80	¶8.80– ‖8.80
Snowflake	.....	¶8.80– ‖8.80
Golden, browns, grey, blues, blacks	¶13.80–‖13.80	¶13.80–‖13.80
Middlebrook, Mo.—Red	.....	20.00– 25.00
Middlebury, Vt.—White	.....	¶9.00–‖10.00
Randville, Mich.—Crystalite, crushed white marble, bulk	4.50	4.50– 5.00
Tuckahoe, N. Y. (b)	5.00– 6.00	.....
Warren, N. H.	.....	¶5.80–11.00

¶C.L. ‖L.C.L. *Per 100-lb. (a) Including bags. (b) 5.00 per ton on 5-ton orders; less than 5 tons, 6.00 per ton.

Art and Cast Stone Aggregates

Cardiff, Md.—Green marble fines in carloads; bulk, 7.50; in bags	10.00
Los Angeles, Calif.—Dolomite aggregates, all sizes and colors†	¶10.00 ‖12.50
Dolomite special cast stone, wet-cast aggregate, white, ¼-in. to dust	a5.30

† 100-lb. sacks. ¶C.L. ‖L.C.L. (a) In open cars.

Miscellaneous Sands

City or shipping point	Roofing sand	Traction
Eau Claire, Wis.	.....	.60
Ohlton, Ohio	1.50	1.50

Glass Sand

(Silica sand is quoted washed, dried and screened)

Klondike, Mo.	2.00
Ohlton, Ohio	2.40
Ottawa, Ill. (Per ton, f.o.b. Ottawa)	1.25
Silica, Va.	2.25–2.75
South Vineland, N. J.	1.50

Chicken Grits

Chico, Tex.—(Limestone) packed in 100-lb. sacks, per cwt., f.o.b. cars at plant	1.00
Cranberry Creek, N. Y.—Per ton	12.00
Davenport, Iowa—High calcium carbonate limestone, in bags, L.C.L., per ton	6.00
Gibsonburg, Ohio.—(Agstone)	5.00– 5.25
Hannibal, Mo.—(Limestone), sacked, f.o.b. plant, per ton	8.00
Indianapolis, Ind.—Per ton	.40
Los Angeles, Calif.—Marble grits, per ton, incl. sacks	10.00–12.50
Maplewood, Mo.—(Limestone), per ton	10.00
Middlebury, Vt.—Per ton (a)	10.00
New York City—Per cu. yd.	1.00
Oriskany Falls, N. Y.—(Limestone) per ton	2.50– 3.75
Port Clinton, Ohio—(Gypsum), per ton	6.00
Salt Lake City, Utah—Per ton	.60
Warren, N. H.—(Aggregate)	7.80–11.00
Waukesha, Wis.—(Limestone), per ton	7.00

(a) F.o.b. Middlebury, Vt.

Talc

Prices given are per ton f.o.b. (in carload lots only), producing plant, or nearest shipping point.

Chester, Vt.—Finely ground talc (carloads), Grade A—99-99¾% thru 200 mesh, 7.50–8.00; Grade B, 97-98% thru 200 mesh. 1.00 per ton extra for 50-lb. paper bags; 166⅔-lb. burlap bags, 15c each; 200-lb. burlap bags, 18c each. Credit for return of burlap bags. Terms 1%, 10 days.	6.50– 7.00
Emeryville, N. Y.:	
Crude ground talc (200 mesh), bags	13.75
Crude ground talc (325 mesh), bags	14.75
Henry, Va.:	
Crude mine run, per ton	3.50– 4.00
Ground talc (150-200 mesh), in bags	4.80– 6.00
Joliet, Ill.:	
Ground talc, 200 mesh, in bags:	
California talc	30.00
Southern talc	20.00
Illinois talc	10.00
Los Angeles, Calif.: Ground talc (200 mesh) in bags	15.00–35.00
Natural Bridge, N. Y.: Ground talc (325 mesh), in 50-lb., 100-lb. and 200-lb. bags, per ton	10.00–20.00

Core and Foundry Sands

Silica sand quoted washed, dried, screened unless otherwise stated; lowest net prices per ton f.o.b. plant

City or shipping point	Molding Fine	Molding Coarse	Molding Brass	Core	Furnace lining	Sand blast	Stone sawing
Albany, N. Y.	1.80	1.80	1.80	.65c	.....	1.50d	.....
Columbus, Ohio	1.50	1.50	.....	.....	.....	3.50	.....
Eau Claire, Wis.	.....	.....	.....	.....	.....	2.00b	.....
Elco, Ill.	Amor. silica, 90-99½% thru 325 mesh,						$10.00
Montoursville, Penn.	.....	.....	.....	1.35a	.....	.....	.....
New Lexington, Ohio	2.50	1.75	.....	.....	.....	.....	.....
Ohlton, Ohio	1.50	1.50	.....	1.50	1.50	1.50	.....
Ottawa, Ill.	.....	.....	.....	.....	.....	3.50	.....

Silica, Va.—Ground silica thru 140 mesh, 8.00.

South Vineland, N. J.—Dry washed silica, 2.00 per ton.

(a) To 1.60. (b) To 3.00. (c) To 2.00. (d) To 3.25.

ROCK PRODUCTS solicits volunteers to furnish accurate price quotations.

Wholesale Prices of Slate

Lowest prices f.o.b. at producing point or nearest shipping point

Slate Flour

Pen Argyl, Penn.—Screened, 200 mesh, 6.00 per ton in paper bags

Slate Granules

Pen Argyl, Penn.—Color, blue-grey, per ton 6.00*

*Bags, 10c each, returnable for credit.

Roofing Slate

Prices per square—Standard thickness

City or shipping point	3/16-in.	¼-in.	⅜-in.	½-in.	¾-in.	1-in.
Bangor, Penn.—						
Gen. Bangor No. 1 clear	10.00	20.00	25.00	29.00	40.00	50.00
Gen. Bangor No. 1 ribbon	9.00	16.00	20.00	25.00	35.00	46.00
No. 1 Albion	7.25	16.00	23.00	27.00	37.00	46.00
Gen. Bangor No. 2 ribbon	6.75	.....	.....	.....	.....	.....
Chapman Quarries, Penn.—						
Smooth texture	9.00–11.00	.....	.....	.....	.....	.....
Rugged	8.25– 9.00	a12.50	b18.00	b21.50	d25.00	e30.00

Pen Argyl, Penn.—Albion blue-grey roofing slate, No. 1 clear, 5.50–6.75; mediums, 5.50–6.25; No. 1 ribbon, 5.50–6.25; punching, all sizes, 35c per square.

(a) To 15.00. (b) To 26.50. (d) To 32.00. (e) To 37.00.

Prices are for standard preferred sizes (standard 3/16-in slates), smaller sizes sell for lower prices. Prices other than 3/16-in. thickness include nail holes. Prices for punching nail holes, in standard thickness slates, vary from 50c to $1.25 per square.

Lime Products

(Lowest carload prices per ton f.o.b. shipping point unless otherwise noted)

	Finishing hydrate	Masons' hydrate	Agricultural hydrate	Chemical hydrate	Ground burnt lime, Bulk	Ground burnt lime, Bags	Lump lime In bulk	Lump lime In bbl.
EASTERN:								
Buffalo, N. Y.	5.50	4.75	4.75	10.50	5.50	7.50	6.00	.....
Cedar Hollow, Devault, Rambo and Swedeland, Penn.	.....	8.00c	8.00c	8.00c	7.00	8.00	8.00	.....
Lime Ridge, Penn.	.....	.....	8.00	.....	6.00	7.00	4.50	.....
CENTRAL:								
Cold Springs, Ohio	.....	4.75	4.75	.....	.....	.....	5.00	.....
White Rock, Gibsonburg, Marblehead, Tiffin, Ohio, and Huntington, Ind.	5.50*	4.75	4.75	10.50	5.50	7.50	6.00	.....
Delaware, Ohio	6.00	5.00	5.00	7.00	.....	.....	5.00	.....
Sheboygan, Wis.	.....	10.50	.....	.....	.....	.....	8.50	19.00
Woodville, Ohio (x)	5.50	4.75	4.75	9.00	5.00	7.00	5.00	14.00
SOUTHERN:								
Eagle Mountain, Va.	.....	8.00	8.00	8.00	.....	8.00	6.50	.....
Keystone, Ala.	.....	8.00	8.00	7.50	.....	.....	5.00	.....
Knoxville, Tenn.	13.50	8.00	8.00	7.50	6.50	.....	6.50	12.50
Cartersville, Ga.	9.00	8.00	8.00	7.50	.....	.....	.....	.....
WESTERN:								
Kirtland, N. Mex.	.....	.....	.....	.....	.....	.....	12.50d	.....
Little Rock, Ark.	.....	11.90	.....	.....	.....	.....	9.90	16.90
San Francisco, Cal. (b)	18.50	16.00	11.00	.....	.....	18.50	.....	.....
San Francisco, Calif.	§19.00	15.00	12.50	14.00	11.00	13.50†	11.00	19.80‖

(a) In 100-lb. bags. (b) Woodburnt lime. (c) In 50-lb. paper. (d) To 15.00. *At White Rock and Gibsonburg, Ohio. ¶In 200-lb. steel barrels. ‖Refund for return of barrels. §To dealers and industrial concerns in carload lots. †To 17.50, plus bags as supplied. (x) Ohio Ritewall hair-fibered finishing lime, per ton, in 50-lb. paper bags, 9.00.

Stone-Tile Hollow Brick

Prices are net per thousand, f.o.b. plant.

	No. 4	No. 6	No. 8
Albany, N. Y.*†	40.00	60.00	70.00
Altadena, Calif.	45.00	55.00	65.00
Asheville, N. C.	30.00	40.00	50.00
Atlanta, Ga.	29.00	42.50	53.00
Auburn, Wash.	.....	50.00	65.00
Brownsville, Tex.	.....	53.00	62.50
Brunswick, Me.	29.50	42.25	55.00
Chula Vista, Calif.	32.50	42.50	50.00
Daytona Beach, Fla.	45.00	55.00	65.00
Frostproof, Fla.	45.00	65.00	75.00
Houston, Tex.	36.00	53.00	66.00
Klamath Falls, Ore.	50.00	60.00	70.00
Longview, Wash.‡	.....	50.00	60.00
Los Angeles, Calif.	29.00	39.00	45.00
Macon, Ga.	25.00	35.00	45.00
Mattituck, N. Y.	45.00	55.00	65.00
Medford, Ore.	50.00	55.00	70.00
Memphis, Tenn.	45.00	50.00	60.00
Mineola, N. Y.	40.00	50.00	60.00
Nashville, Tenn.*	32.00	50.00	60.00
New Orleans, La.	45.00	55.00	65.00
Norfolk, Va.	33.00	46.00	60.00
Palm Springs, Calif.	45.00	60.00	70.00
Passaic, N. J.	42.50	55.00	75.00
Pawtucket, R. I.	27.50	41.25	55.00
Presidio, Tex.	55.00	65.00	75.00
Roanoke, Va.	32.50	40.00	50.00
Salem, Mass.	40.00	60.00	75.00
San Antonio, Tex.	37.00	46.00	60.00
San Diego, Calif.	35.00	44.00	52.50
Spartanburg, S. C.	32.50	40.00	52.50

Prices are for standard sizes—No. 4, size 3½x4x12 in.; No. 6, size 3½x6x12 in.; No. 8, size, 3½x8x12 in. *Delivered on job. †10% discount. ‡Stonetile, per 1000 at plant, 4x6x8, 55.00; 4x8x8, 64.00.

Concrete Block

Prices given are net per unit, f.o.b. plant or nearest shipping point.

Camden, N. J.:			
8x8x16 in., each	.....	.....	.16a
Lexington, Ky.:			
8x8x16 in.	.....	.....	‡18.00*
8x8x16 in.	.....	.....	†16.00*
Omaha, Neb. (Prices delivered):			
8x8x16 in., each	.....	.12¶	.14‡
8x12x16 in., each	.....	.16¶	.18‡
8x4x16 in., each	.....	.07½¶	.09½‡
Wichita, Kan.:			
4x8x16 in., each	.....	.....	.07

*Price per 100 at plant. †Rock or panel face. ‡Face. ¶Plain. (a) Less 5%.

Cement Drain Tile

Longview, Wash.—Price per foot.

3-in.	.05	6-in.	.10
4-in.	.06	8-in.	.15

Cement Roofing Tile

Prices are net per square carload lots, f.o.b. nearest shipping point, unless otherwise stated.

Cicero, Ill.—French and Spanish tile, 9x15-in., per sq.	9.50–12.00
Closed end shingle, 8½x12½ in., per sq.	11.00–13.00
New York City, N. Y.—9x15 in., red, per sq., 10.00; green, per sq.	12.00

Rock Phosphate

Prices given are per ton (2240 lb.) f.o.b. producing plant or nearest shipping point.

Lump Rock

Fernandina, Fla., B.P.L. 77/76%, per ton	6.50
Mt. Pleasant, Tenn.—B.P.L., 75%, per ton	6.25

Ground Rock

(2000 lb.)

Mt. Pleasant, Tenn.—(Lime phosphate) —B.P.L. 75%; per ton, bags extra	*12.80
—B.P.L. 60–65%, rock phosphate, per ton	†7.50
Ground rock, B.P.L. 72%, per ton	5.00– 5.50

*80–90% thru 300 mesh.
†40–60% thru 300 mesh.

Florida Phosphate

(Raw Land Pebble)

Mulberry, Fla.—Gross ton, f.o.b. mines	
68/66% B.P.L.	3.15
70% minimum B.P.L.	3.75
72% minimum B.P.L.	4.25
75/74% B.P.L.	5.25
77/76% B.P.L.	6.25

Cement Building Tile

Lexington, Ky.:		
5x8x12, per 1000		55.00
4x5x12, per 1000		35.00
Wichita, Kan. (Duntile)	Plain	Glazed
8x8x12-in., each	.08	....
6x8x12-in., each	.07	....
6x6x12-in., each	.06	....
4x5x12-in., each	.05	.08
4x4x12-in., each	.04	.07½

Concrete Brick

Prices given per 1000 brick, f.o.b. plant.

	Common	Face
Longview, Wash.	15.00	25.00– 60.00
Milwaukee, Wis.	12.50	20.00
Omaha, Neb.	15.00	.....
Prairie du Chien, Wis.	12.00	20.00– 22.50
Wichita, Kan., per 100	*8.00	*8.50

*8x8x16 size.

Potash Feldspar

Bedford Hill, N. Y.—Color, white; analysis, K_2O, 11%; Na_2O, 2.50%; SiO_2, 68%; Fe_2O_3, 0.06%; Al_2O_3, 18.25%; pulverized, 99% thru 20 mesh; per ton, in bags, 11.45; bulk	10.25
Spruce Pine, N. C.—(Chemically controlled.) Color, white; 200 mesh; analysis, K_2O, 11.30%; Na_2O, 2%; SiO_2, 67%; Fe_2O_3, 0.10%; Al_2O_3, 18%; per ton, in bulk	15.00
Spruce Pine, N. C.—Color, white; analysis, K_2O, 10%; Na_2O, 2.50%; SiO_2, 69%; Fe_2O_3, 0.08%; Al_2O_3, 17.75%; pulverized, 99% thru 20 mesh; in bags, per ton, 10.70; bulk	9.50
Topsham, Me.—White; analysis, K_2O, 9.25%; Na_2O, 3%; SiO_2, 71%; Fe_2O_3, 0.09%; Al_2O_3, 16.75%; pulverized, 99% thru 200 mesh; per ton in bulk, 17.25; in bags	17.45
Trenton, N. J.—White; analysis, SiO_2, 69%; Na_2O, 3%; K_2O, 9%; Fe_2O_3, 0.08%; Al_2O_3, 18%, pulverized, 99% thru 200 mesh; per ton, in bulk, 19.00; in bags, per ton	20.20
West Paris, Me.—(Chemically controlled.) Color, white; 200 mesh; analysis, K_2O, 11.20%; Na_2O, 3.20%; SiO_2, 65.70%; Fe_2O_3, 0.09%; Al_2O_3, 19.20%; per ton, in bulk	19.00

Soda Feldspar

Spruce Pine, N. C.—(Chemically controlled.) Color, white; 200 mesh; analysis, K_2O, 5.50%; Na_2O, 5.50%; SiO_2, 68.80%; Fe_2O_3, 0.10%; Al_2O_3, 18.60%; per ton, in bulk	18.00

Fullers Earth

Prices per ton in carloads, f.o.b. Florida shipping points. Bags extra and returnable for full credit.

16– 30 mesh	20.00
30– 60 mesh	22.00
60–100 mesh	18.00
100 mesh and finer	9.00
Joliet, Ill.—All passing 100 mesh, f.o.b. Joliet, including cost of bags	22.00

Whiting

St. Louis, Mo., per ton	15.00*
Chicago, Ill., prices per ton.	
Domestic putty whiting	10.00–12.00
Domestic precipitated whiting	15.00–20.00
Imported bolted whiting	30.00–35.00
Philadelphia, Penn.—English chalk whiting packed in 50-lb. paper bags, per ton, in carloads	15.00

*Packed in bbl., f.o.b. St. Louis.

Current Prices Cement Pipe

Prices are net per foot f.o.b. cities or nearest shipping point in carload lots unless otherwise noted

Culvert and Sewer	4-in.	6-in.	8-in.	10-in.	12-in.	15-in.	18-in.	20-in.	22-in.	24-in.	27-in.	30-in.	36-in.	42-in.	48-in.	54-in.	60-in.
Grand Rapids and Saginaw, Mich.																	
Culvert (b)	.....	.....	.....	.55	.60	1.00	1.35	1.60e	.....	1.80	2.00	2.25	3.10	.....	.....	.....	.....
Longview, Wash.																	
Culvert	.....	.30	.40	.....	.55	.....	1.10	.....	.....	1.50	.....	2.70	4.25	5.00	.....	.....	.....
Newark, N. J.																	
Unreinforced	.08	.16	.26	.36	.46	.56	.90	1.10	1.26	1.50	.....	.....	.....	.....	.....	.....	.....
Reinforced	.....	.....	.....	.....	.90	1.05	1.40	1.60	1.75	2.05	2.60	3.00	4.00	5.00	6.00	8.50	12.00
Wahoo, Neb.	12-in., 15-in., 18-in., 24-in., and from 30-in. to 60-in. pipe, per ton, 10.00																

(a) Reinforced. (b) To contractors. (e) 21-in. pipe.

Gypsum Products—CARLOAD PRICES PER TON AND PER M SQUARE FEET, F.O.B. MILL

City or shipping point	Crushed Rock	Ground Gypsum	Agricultural Gypsum	Stucco Calcined Gypsum	Cement and Gaging Plaster	Wood Fiber	Gaging White	Plaster Sanded	Cement Keene's	Finish Trowel	—Plaster Board— ⅜x32x 36". Per M Sq. Ft.	⅜x32x 36". Per M Sq. Ft.	Wallboard, ⅜x32 or 48" Lengths 6'-10'. Per M Sq. Ft.
East St. Louis, Ill.—Special Gypsum Products—Partition section, 4 in. thick, 12 in. wide, and up to 10 ft. 3 in. long, 12c per ft., 21.00 per ton; outside wall section and interior bearing wall section, 6 in. wide, 6 in. thick, and up to 10 ft. 3 in. long, 25c per ft., 30.00 per ton; floor section, 7 in. thick, 16 in. wide, and up to 13 ft. 6 in. long, 17c per ft., 23.00 per ton.													
Los Angeles, Calif. (r)	.....	.....	8.02p	.....	12.40q	.....	13.40a	.....	.....	.....	.....	.....	.....
Medicine Lodge, Kan.	1.40	8.00b	.....	.....	.....	.....	11.50b	.....	16.00b	.....	.....	.....	.....
Port Clinton, Ohio	4.00	6.00–8.00	6.00–8.00	10.00m	10.00n	10.00n	20.00k	8.00–11.00	24.50f	26.00g	15.00h	15.00h	27.00j
Winnipeg, Man.	5.00	5.00	7.00	13.00	14.00	14.00	.....	.....	.....	.....	20.00	25.00c	33.00d
Woodville, Ohio	.....	.....	.....	.....	.....	.....	.....	.....	25.50b	.....	.....	.....	.....

NOTE—Returnable bags, 10c each; paper bags, 1.00 per ton extra (not returnable). (a) To 14.40 per ton. (b) Includes paper bags. (c) Includes jute sacks. (d) "Gyproc," ⅜x48-in. by 5 and 10 ft. long. (f) To 27.50. (g) To 29.00. (h) To 16.00. (j) To 28.00. ((k) To 23.00. (m) To 12.00. (n) To 13.00. (p) To 9.02. (q) To 13.40 per ton. (r) Plaster board, $\frac{5}{16}$-in., per yd., 14½c; ⅜-in., per yd., 16½c.

News of All the Industry

Incorporations

Battle Creek Sand and Gravel Co., Battle Creek, Mich., $15,000.

Brown-Huffstetter Sand Co., Indianapolis, Ind., final dissolution.

Atlas Crushed Stone Co., Inc., Wilmington, Del., $250,000, 5000 shares common.

Cast Stone Products, Inc., Houston, Tex. C. F. Fleming, 7121 Harrisburg Blvd., Houston.

Philip Creter Co., Inc., Irvington, N. J., $125,000. To manufacture cement burial vaults.

Cassaday Grey Granite Co., Llano, Tex., decreased capital stock from $70,000 to $50,000.

Malvern Gravel Co., Malvern, Ark., $30,000. H. F. Riley, president, and E. M. Hall, secretary.

Ische Sand and Gravel Co., Milwaukee, Wis., $20,000. Augusta C. Ische, Volney L. Ische and H. C. Ische.

C. E. and P. A. Roth, Madison, Wis., 500 shares at $100 each. C. E. Roth and P. A. Roth. To deal in building materials.

Black Hawk Asbestos Co., Trenton, N. J., 1000 shares common. Ellis L. Pierson, Trenton, N. J. To produce asbestos products.

Lindsley Building Products Corp., Milwaukee, Wis., 1000 shares of no par value. G. F. Lindsley, H. A. Braun and C. Juergens.

Garden State Materials Corp., Camden, N. J., $125,000. Lawrence V. White, Camden. To deal in concrete and other building materials.

Asbestocrete Products, Ltd., Montreal, Que., Can., 4000 shares of no par value. To manufacture and deal in asbestos products, wallboards, etc.

Rainbow Granite Co., Mellen, Wis., 500 shares of no par value. J. Swanson, T. E. Stam and A. H. Stam. To deal in granite, building stone, etc.

Rolstone Granite Co., Fitchburg, Mass., 1000 shares common of no par value. Samuel M. Salny, president; Philip Salny, treasurer, 327 Main St., Fitchburg, and Ruth Williams.

North Kingsville Cement Products, Inc., North Kingsville, Ohio, 150 shares common no par stock and $10,000 preferred stock. H. P. Stearns, 635 Guardian Bldg., Cleveland, Ohio.

San Antonio Rock Products Co., Upland, Calif., $25,000. J. H. Briscoe and J. A. Cassidy of Pomona and W. R. Brooks of Long Beach, Calif. To produce and deal in stone, rock, gravel, etc.

Marble and Stone Co. of Canada, Ltd., Toronto, Ont., Can., $50,000, consisting of 500 shares of $100 each. To quarry and deal in marble and stone. Andrew A. Shuyler and Lily Illingworth.

La Compagnie d'Amiante de Thetford, Ltd., Thetford Mines, Que., Can., $99,000, consisting of 990 shares with par value of $100 each. T. Perron, Joseph O. Gregoire, J. E. A. Perrault and T. Labbe, all of Thetford Mines. To produce asbestos.

Larimer and Shaffer, Cedar Rapids, Ia., $250,000. Robert I. Larimer, president; Gustave A. Shaffer, vice-president, and R. Vincent Roupe, secretary-treasurer. To produce crushed stone and sand and gravel. (Apparently an incorporation of an existing partnership.)

Red-D-Mix Concrete (Hamilton) Ltd., Hamilton, Ont., Can., 300 shares preferred with par value of $100 each and 5000 shares common of no par value. Colin W. G. Gibson, Robert F. Inch and Henry E. B. Coyne. To manufacture and deal in cement, concrete and byproducts.

La Compagnie de Marbre et de Terrazzo des Laurtentides, Ltd., Montreal, Que., Can., 999 shares preferred, with par value of $100 each, and 2000 no par value common shares. Ovide Brassard, Joseph O. Dubois and Aquila Guenette, all of Montreal. To quarry marble, granite and other stone.

Quarries

Colorado-Yule Marble Co., Marble, Colo., lost its transformers and transformer houses in a fire recently.

Tobin Rock Co., Fayette, Mo., has opened a rock quarry near Fayette. Rock will be used for river work.

East Quarry Co., Glencoe, Ala., is reported as planning purchase of pulleys and conveyor belt for its quarry plant.

Mineral Wells Crushed Stone Co., Mineral Wells, Tex., had its power plant and crusher damaged by fire recently.

Centropolis Crusher Co., Kansas City, Mo., has acquired 50 acres of property near Dodson. It is said the purchase was to obtain a reserve supply of rock.

George Waldenmaire, Jr., Albany, N. Y., is asking $3000 for flagstone which he claims was removed from his quarry by the Kent Construction Co. and John H. Gordon.

Arthur Construction Co. is suing Richland county, Wis., claiming damages against the county for moving its stone quarry and making the cost of producing crushed rock greater.

New York Trap Rock Corp., New York, N. Y., has ordered a complete Northern dust collector system for its plant at Verplanck, N. Y., to be installed in the limestone department.

C. B. Johnson, Garden City, Mo., was awarded contract for crushing and distributing 400 tons of rock for the city. His bid was 65c per ton, which is to be paid by the city, and the labor is to be paid for from the local charity fund.

George H. Hendricks, Easley, S. C., has leased rock deposits near Arial Mill, S. C., to North Carolina interests under which a quarry will be opened soon, it is reported. The deposit compares favorably, the report says, with stone now being produced in Rhode Island.

Sand and Gravel

Ingham county, Mich., has purchased a gravel plant and land adjacent near Mason.

Sterling, Mich. A gravel pit was recently opened by the county road commission near here.

Ohio Gravel Co., Cincinnati, Ohio, plans an addition to its office. A permit has been granted.

Lancaster Coal and Sand Co., Wilber, Ohio, plans to rebuild part of plant recently destroyed by fire.

Columbia Sand and Gravel Co., Hamilton, Ohio, is reported to be defendant in action asking that a receiver be appointed.

Material Service Corp., Chicago, Ill., lost a storehouse containing electrical equipment at its plant in Lockport recently.

Edgerley, N. D. Farmers of this vicinity and business men of the city recently graded more than 20 blocks of the city streets.

Hillside Washed Sand and Gravel Co., Milwaukee, Wis., is defendant in an involuntary petition for bankruptcy, it is reported.

Wheeling W. Va. Sand digging on the Ohio river has been brought almost to a standstill during the high water stages of the last six weeks.

Detroit, Mich. The sand and gravel freighter, *E. C. Pope*, which has seen more than 40 years of service on the Great Lakes, was sold at auction recently for $500.

Colonial Sand and Stone Co., New York, N. Y., has been given contract for 30,000 truckloads of sand, gravel, grit and crushed stone to be used in Radio City.

Highland Park Sand Co., Inc., Richmond, Va., reports it is experiencing satisfactory activity. A publicity story was recently given it in the local newspaper.

Columbia Sand and Gravel Co., Middletown, Ohio, has been granted permission, through State Superintendent I. J. Fulton, to compromise a judgment of $5290.85 for $3057.04.

Warren Silica Sand Co., Tidioute, Penn., has taken over property near there and will remodel plant for producing silica sand. It is estimated cost will be over $24,000. C. C. Hartman, Greensburg, Penn., and associates are interested.

Fred R. Wagner, Scranton, Penn., has filed a bill in equity against the Rocky Glen Sand and Gravel Co. and its president, asking that the defendant be restrained from interfering with his operation of a sand pit at Glendale.

Cement

Green Bag Cement Co., Pittsburgh, Penn., has renewed its lease for wharf space in Cincinnati.

Petoskey Portland Cement Co., Petoskey, Mich., announces it will resume operations about April 1.

Alpha Portland Cement Co. had a meeting of executives and salesmen at Ironton, Ohio, recently.

Southwestern Portland Cement Co. has resumed operations at its El Paso, Tex., plant following a 16-day shutdown for repairs.

Calaveras Cement Co. celebrated winning the Safety Trophy at its San Andreas, Calif., plant with a banquet and entertainment.

Dewey Portland Cement Co. held a three-day meeting of its salesmen in Bartlesville, Okla., recently. An inspection of the plant was made and new products discussed.

International Non-Staining Cement Co., Inc., Brooklyn, N. Y., has issued a 4-page folder describing *Ciment Fondu*, which it claims is the original high-alumina cement.

Pacific Portland Cement Co., San Francisco, Calif., has appointed Albert Frank and Co. advertising agency to direct its advertising account. Building and architectural publications and direct mail will be used.

Cement Products

Anamosa Cement Products Co., Anamosa, Ia., has moved to new quarters in the postoffice block. Here it will have modern office conveniences.

Wapakoneta Cement Block Co., Wapakoneta, Ohio, a 20-year-old company, was placed in receivership January 4 to liquidate its financial affairs in the most economical manner.

Concrete Conduit Co., Ltd., Colton, Calif., recently received a long news story in the *San Bernardino Sun* based on the description of its operations in the December issue of *Concrete Products*.

Norfolk Mausoleum and Vault Co., Inc., which manufactures the "Indestructible Mausoleum," has begun operations in Norfolk, Va., at its plant. The Haycox Concrete Co. has charge of the manufacture.

S. M. Campbell, who operates a concrete block plant in Owosso, Mich., reports a 50% reduction in volume of business during 1931, but anticipates improved conditions for the coming year. Mr. Campbell manufactures Duntile and a general line of concrete blocks and burial vaults.

Turton Brothers, manufacturers of cast stone, announce their removal to a new plant on the River road at Loughborough, Md. New equipment and improved facilities are provided, together with ample space, and they advise they can now handle all orders promptly and efficiently.

Superior Ready-Mixed Concrete Co., Cincinnati, Ohio, recently carried a full-page advertisement in the *Cincinnati* (Ohio) *Press* in cooperation with a number of manufacturers. The advertisement featured the facilities of the company and the 3500-ft. Western Hills bridge on which it furnished ready-mixed concrete.

Santa Ana, Calif. A letter urging the board of supervisors to cooperate with the Orange county division of the president's committee for relief of unemployment by specifying locally manufactured cement products was read to the board recently by the county clerk. The communication was signed by the secretary of the Santa Ana chamber of commerce.

Marietta Concrete Corp., Marietta, Ohio, reports a busy year in 1931. Preferred dividends were paid from earnings for the year. The company has developed an improved grave vault and is now forming a marketing organization. Plant improvements and enlargements to take care of this development were authorized at a recent meeting of the stockholders.

Doswell and Kover, Fort Wayne, Ind., was recently featured in a new story in the *Fort Wayne Journal-Gazette*. Its air-sealed vault and the acceptance of its product in Fort Wayne, where it is said more than 98% of all local vault interments are made in the Doswell and Kover vault, were featured in the story.

Ready-Mixed Concrete Corp., Richmond, Va., has made application to reduce its maximum authorized capital stock from 2000 shares of common without par value and 100,000 preferred to 250 shares common without par value. It is also reducing its actually issued outstanding capital stock. John Twohy II is president.

Gypsum

North American Gypsum Co., Ltd., has decided to erect a gypsum products plant either in Baddeck or Sydney, N. S.

CRUSH

WITH

NEWHOUSE CRUSHERS

YOU will like the short, rapid crushing action of this crusher and the grading of the product. The method of suspending the crusher from the framework of the building eliminates expensive foundations and permits installing the crusher in the most advantageous locations. It is a simple crusher with a direct connected motor. There are no gears, pinions, pulleys, or belts. The few working parts are lubricated through a positive oiling system that includes a filtering and cooling unit.

Bulletin 1469-B tells more about the Newhouse Crusher. Just write for it.

ALLIS-CHALMERS

Allis-Chalmers Manufacturing Company, Milwaukee

Lime

Erin Lime Co., Erin, Tenn., is producing agricultural limestone and G. W. Burgess, who is operating the property, reports he is negotiating for disposition of a large quantity of burned lime in bulk and barrel. Improvements are being made and two kilns will open about March 1.

Silica

Pennsylvania Glass Sand Corp. is installing dust collectors ordered from the Northern Blower Co. at its Toms River, N. J., and Newport, N. J., plants.

Eastern Silica and Chemical Co., formerly operating glass sand deposits near Gore, Va., will divide $25,000 among creditors as a result of a fire insurance settlement made recently.

Miscellaneous Rock Products

Texas Potash Corp., Dallas, Tex., plans to erect a plant to refine potash salts near Odessa.

Consolidated Mining and Smelting Co. has made its first shipment of sulphate of ammonia fertilizer to China.

W. B. Stoker, who has erected an asphalt rock plant near Pleasanton, Kan., will soon have the plant in operation.

Macon, Ga. A permanent collection of minerals and rocks found within a 25-mile radius of Macon will be maintained in the three Macon high schools.

Charles M. Griffee, Des Moines, Ia., has obtained mineral rights in Texas to a deposit of potassium nitrate which is estimated at more than a million tons.

Fort Laramie, Wyo. A deposit of glacial origin said to contain potash, lime, manganese and other elements has been discovered on the W. W. Hunt farm near here.

F. A. Fischrupp, Charlotte, N. C., has acquired land containing feldspar and mica near Spruce Hills. It is reported he will install drills, crushers and other machinery for drilling and mining.

Continental Chemical Co., Dallas, Tex., has leased a group of lakes near Tahoka and plans to construct an evaporating and refining plant to recover potash and other chemical products of water. It is reported they will spend $1,600,000.

Personals

Earl A. Webster is now associated with the Peter Burghard Stone Co., Louisville, Ky.

C. M. Loveland has been appointed chief engineer for the American Portland Cement Co., Inc., Little Rock, Ark.

George J. Patterson, director, Seaboard Sand and Gravel Co. and Standard Trap Rock Corp., has been elected a director of the Manufacturers Trust Co.

Grant McGowan, president, Ideal Sand and Gravel Co., Mason City, Ia., was recently featured in the local paper. The operation of the company was described.

H. T. Thomson, vice-president, General Material Co., St. Louis, Mo., was author of "Winter Work Is Worthwhile," an article in the January issue of the *Constructor*.

Lee S. Trainor of the National Lime Association was author of an article, Winter Mortar for Unit Masonry, which appeared in a recent issue of the *Constructor*.

C. K. Boettcher, director of the Ideal Cement Co., Denver, Colo., was elected president of the Colorado Association, whose purpose is to publicize Denver and Colorado.

W. E. Hart, manager, Structural Bureau, Portland Cement Association, and **John F. Hough,** assistant manager, each had an article in the January issue of the *Constructor*.

Mallory Jenkins has been appointed general manager of the Louisiana Quarry Co., Winfield, La. He takes the place of R. S. Wilson, Jr., who has been transferred to Boston.

C. J. Jones, lime plant engineer, York, Penn., formerly designing engineer of the lime plant department of the Blaw-Knox Co., announces he has established a lime plant engineering service.

William E. Umstattd has been elected executive vice-president of the Timken Roller Bearing Co., Canton, Ohio. He has been with the Timken company for 13 years and for the last two years has been factory manager.

W. A. Olen, president and general manager, Four Wheel Drive Auto Co., Clintonville, Wis., has been elected to the board of directors of the manufacturers' division of the American Road Builders' Association.

T. B. Warden, formerly manager of the highway department of the Texas Chamber of Commerce, has been appointed district engineer of Texas for the Portland Cement Association. Mr. Warden has been active in highway work in Texas for many years.

Stanton Walker, director, engineering and research division, National Sand and Gravel Association, has been appointed one of the A. S. T. M. representatives on the Joint Committee on Concrete and Reinforced Concrete, succeeding Cloyd M. Chapman, resigned.

Obituaries

John H. Schulte, Covington, Ky., 57, vice-president of the Ohio Valley Rock Asphalt Co., Louisville, Ky., and president of the Central Savings Bank and Trust Co., Covington, died at his home January 15.

F. D. Kamerer, 41, auditor of disbursements, General Electric Co., died at his home in Schenectady, N. Y., January 29. He has been associated with the General Electric Co. and a subsidiary company since 1918.

Manufacturers

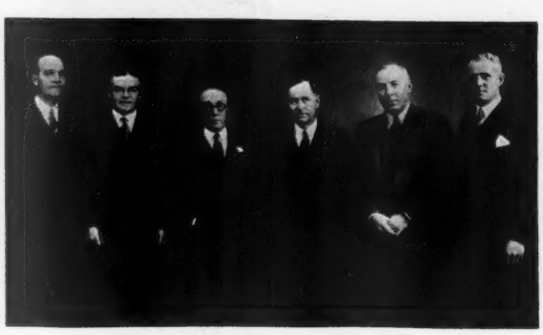
Allis-Chalmers Manufacturing Co., Milwaukee, Wis., announces the appointment of L. W. Grothaus to succeed C. F. Searle as general representative. Mr. Grothaus needs no introduction to the industries of power generation and utilization. He became affiliated with Allis-Chalmers with the acquisition of the Bullock Electric Manufacturing Co. in 1904. Mr. Grothaus was transferred to the home office at Milwaukee in 1908, where he has served in various capacities, both in Milwaukee and in other locations. Previous to his most recent appointment he was serving as assistant manager of the electrical department. His appointment as general representative became effective January 1, 1932. General Falk, president, in announcing Mr. Searle's resignation, states that "It is with great regret that I am obliged to announce Mr. Searle's resignation. He has proven a capable executive, a faithful and conscientious worker, and has endeared himself to the organization, all of whom join me in extending best wishes for his future success."

L. W. Grothaus

Gears and Forgings, Inc., Cleveland, Ohio, has appointed Frick-Reid Supply Corp., Pittsburgh, Penn., as jobbers to handle the G & F line of speed reducers in its territory.

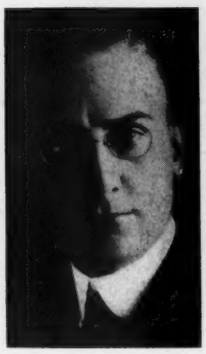
Allen Bradley Co., Milwaukee, Wis., has opened a permanent exhibit of motor control equipment in the Engineering Building, Chicago, Ill. Controls shown range in size from small push-button stations to automatic high tension motor starters of several hundred horsepower ratings.

Westinghouse Electric and Manufacturing Co. held a four-day general sales conference at East Pittsburgh, Penn., December 14-18. Markets, policies, engineering developments and research progress were among the subjects discussed. The conference was held under the direction of J. S. Tritle, vice-president and general manager.



Left to right: C. E. Stephens, J. S. Tritle, F. A. Merrick, N. G. Symonds, S. M. Kintner, and W. R. Marshall

Worthington Pump and Machinery Corp., New York, N. Y., announces the following personnel changes effective February 1: C. E. Wilson, formerly general sales manager, has been appointed vice-president in charge of industrial relations. He has been associated with Worthington since 1899.



C. E. Searle

C. E. Wilson

Clarence E. Searle, formerly general representative in charge of sales for Allis-Chalmers Manufacturing Co., has been appointed vice-president in charge of sales; William H. Baumes, for 14 years treasurer, retired; Charles N. Barney, for 14 years secretary and general counsel, is now secretary, treasurer and general counsel; A. L. Prentice, formerly assistant comptroller, is now assistant treasurer; Waller Lehman remains as formerly, assistant treasurer in charge of credits; and Frank D. Talmage, formerly member of the counsellor's staff, is now assistant secretary.

Lincoln Electric Co., Cleveland, Ohio, announces R. D. Eaglesfield has been appointed district manager in charge of motor and welding equipment sales with headquarters in Indianapolis.

Byers Machine Co., Ravenna, Ohio, announces that the W. T. Walsh Equipment Co., Cleveland, and the Boehek Equipment Co., Milwaukee, have been added to its distributor organization.

Allis-Chalmers Manufacturing Co., Milwaukee, Wis., announces it has purchased patents and inventions of the Ryan Manufacturing Co., manufacturers of road-building and maintenance equipment.

Westinghouse Electric and Manufacturing Co., East Pittsburgh, Penn., announces the election of George H. Bucher as vice-president and general manager. He has been associated with the Westinghouse organization since 1909.

Linde Air Products Co., New York, N. Y., has prepared a movie, "New Lindeweld Process for Pipe Line Construction," which shows the construction of a 20-in. natural gas line by Lindeweld process. The film comprises two reels.

National Equipment Corp., Milwaukee, Wis., has dissolved the merger of two of its divisions, the C. H. & E. Manufacturing Co., Milwaukee, and the Insley Co., Indianapolis, Ind. The National Equipment Corp. was formed in 1928 through the merger of six companies engaged in the manufacture of construction equipment.

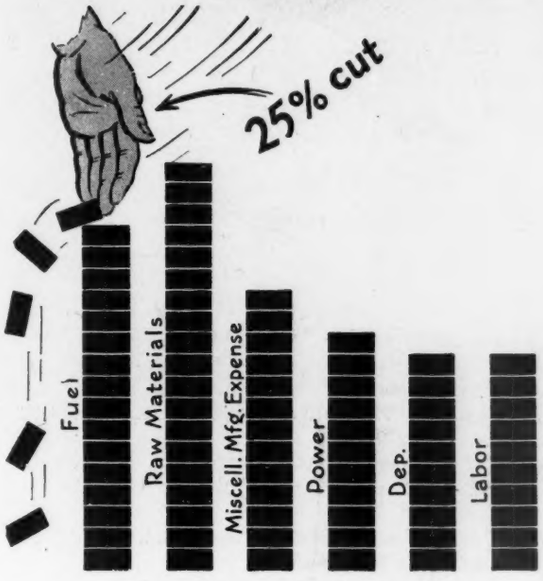
Lincoln Electric Co., Cleveland, Ohio, announces the appointment of B. F. McIntyre to have charge of motor sales in Chicago. It also announces that Fred Archer, formerly president of Fred Archer, Inc., has been appointed to the Philadelphia office in charge of motor sales.

Industrial Brownhoist Corp., Cleveland, Ohio, announces its general offices are now located at Bay City, Mich. A district sales office will be continued at 4403 St. Clair avenue, Cleveland. This move, the company anounces, will effect increased efficiency and convenience in operating, hence service to customers will materially benefit.

Four Wheel Drive Auto Co., Clintonville, Wis., announces the appointment of J. R. Gray to the position of district sales manager in charge of eastern Pennsylvania and southern New Jersey. He will be succeeded in southern Wisconsin by J. J. Kingston, also a veteran of the Wisconsin sales division and formerly in charge of the east central portion of the state.

Lukenweld, Inc. (division of Lukens Steel Co. of Coatesville, Penn.), has appointed two new representatives to handle the sale and service of its products. In Wisconsin it is now represented by Welding Engineering Co., Milwaukee. In the Buffalo, N. Y., territory (including Erie county, Penn., and New York from the western boundary to Utica), it is represented by Marvine Gorham, Jackson Bldg., Buffalo.

KNOCK DOWN Your Highest Cost Item



Percentage of cost per barrel

The make-up of the average production cost of a barrel of cement is given by the U. S. Tariff Commission's report, issued in November, 1931, as follows:

Fuel	24.4%
Raw materials (quarried and purchased)	22.0
Miscell. mfg. expenses	15.8
Power	13.3
Depreciation (plant, bldgs. and equipment)	12.3
Manufacturing labor	12.2

Fuel shows up as the largest single item in this compilation, which includes both wet and dry plants. If wet plants only were considered, the fuel cost would be proportionately much larger.

OLIVER UNITED SLURRY FILTERS CUT FUEL COSTS 25-30 PER CENT

More than twenty wet process cement mills have found that Oliver United Slurry Filters have made this saving in their fuel bill. Why not let us figure out the savings that can be made in YOUR plant? Drop a line to our nearest office.

OLIVER UNITED FILTERS INC.

SAN FRANCISCO
Federal Reserve Bank Bldg.

NEW YORK
33 West 42nd Street

PARIS

CHICAGO
221 North La Salle Street

TORONTO
330 Bay Street

LONDON

TOKYO	Andrews & George Co., Inc.	SCHEVENINGEN, HOLLAND and	
MELBOURNE	Crossle & Duff, Pty., Ltd.	SOERABAJA, JAVA,	Van Lelyveld & Co.
MANILA	The Edward J. Nell Co.	RECIFE, BRAZIL	Ayres & Son
STOCKHOLM	T. An Tesch	JOHANNESBURG—E. L. Bateman, Pty., Ltd.	

FACTORIES: Oakland, Cal., Hazleton, Pa., Peterboro, England. Cable Address: OLIUNIFILT

Recognized the World Over as the Leader in Its Field

Rock Products

With which is incorporated CEMENT and ENGINEERING NEWS Founded 1896

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